17VC CHASSIS

OPERATION MANUAL
TROUBLESHOOTING MANUAL

REVISED

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TRINITRON® COLOR COMPUTER DISPLAY

SONY®

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CIRCUIT DESCRIPTION

D BOARD POWER SUPPLY SECTION

Power Supply Electrical Circuit

The power supply is located on the D Board. It has three modes of operation that are controlled by a microprocessor. The topology is a discontinuous mode flyback converter with photocoupler feedback for regulating the secondary voltages. Circuit operation and troubleshooting are explained in the following sections:

Operation Modes **Secondary Circuitry**
AC Input **Protection Circuits**
Degauss Circuit **Troubleshooting**
Primary Circuitry **USB/Audio Power Circuit**

Operation Modes
The power supply has four modes of operation, 'off', 'active off', 'suspend/standby' and 'active on'. These modes are related to power savings and are indicated by the front panel LED. Additional indications are failure diagnostics and aging mode. The table below lists operation mode, condition and LED status.

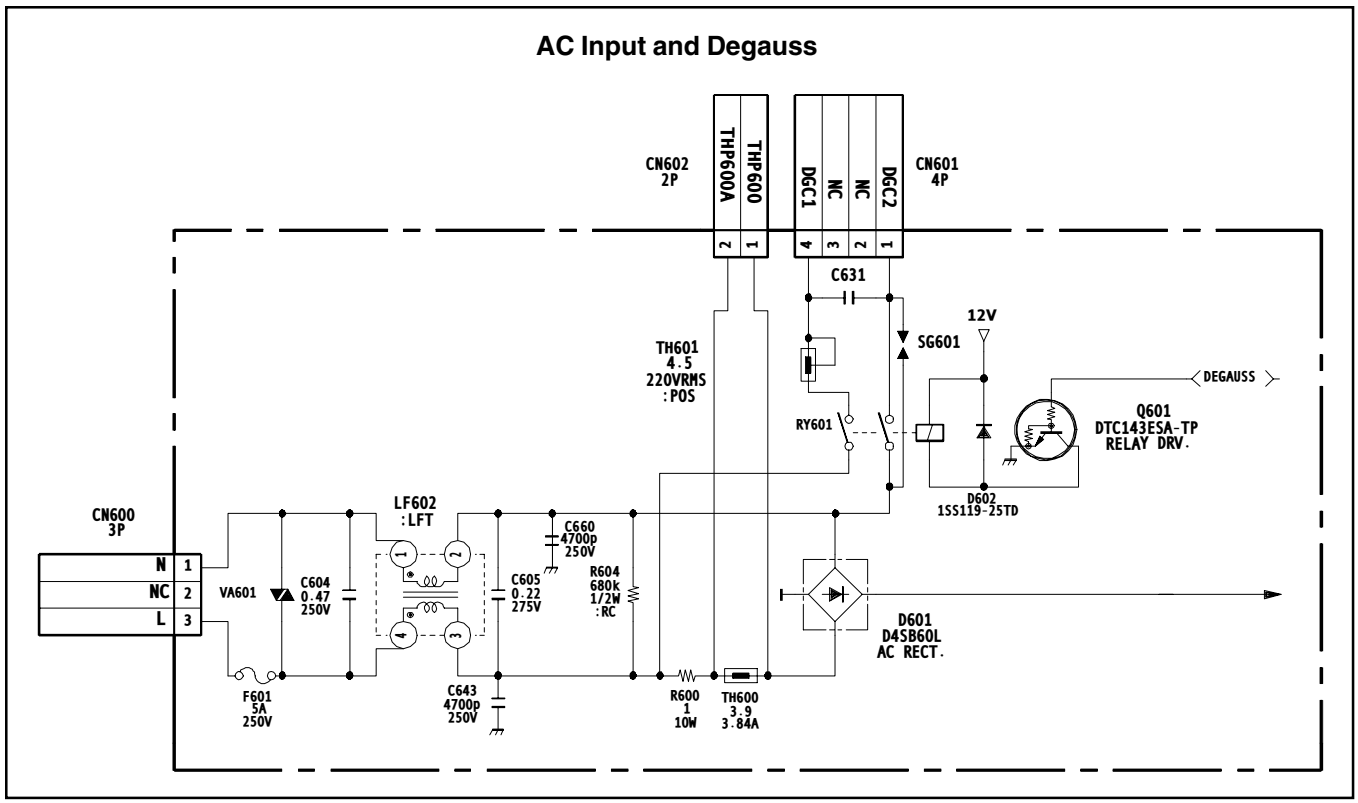
Mode	Syncs	Condition	LED
Off	N/A	Power Switch Off	Off
Active Off	No H and/or V	Low Power, Heater Off	Amber
Active On	H and V Present	Phase Locked, Normal Operation	Green
Failure 1	N/A	HV Failure	Amber 0.5s<-->Off 0.5s
Failure 2	N/A	H Stop, V Stop, S Cap Failure	Amber 1.5s<-->Off 0.5s
Failure 3	N/A	ABL Failure	Amber 0.5s<-->Off 1.5s
Aging/Self Test	No H and V	Aging Raster or Test Pattern	Amber 0.5s<-->Off 0.5s Green 0.5s<-->Off 0.5s Amber 0.5s<-->Off 0.5s

Except for power switch off, all modes of operation are controlled by the microprocessor located on the D Board. The failure modes are detected by the microprocessor and the power supply is forced into active off mode. These functions are discussed later (Deflection).

With the AC cord attached to the monitor and connected to an AC source, the monitor will be off until the power switch is turned on. When the power switch is turned on, the power supply starts and is in active off mode. The next step is active on mode. The active off power saving mode is activated by the microprocessor based upon the absence of either H or V sync. If H and/or V sync signals are not present, the power supply is set to active off mode.

Power supply operation control signals are "Remote Sw", "Power Sw" and "PFC Sw". During active off mode, Remote Sw and Power Sw are digital low and PFC Sw is digital high. To enter active on mode, the microprocessor sets PFC Sw to digital low, then 300mS later, Remote Sw and Power Sw are set to digital high.

Output	Off	Active Off	Active On
180V (B+)	0V	+13V	+179V
80V	0V	+6V	+79V
+15V	0V	+1V	+15V
-15V	0V	-1V	-15V
+12V	0V	0V	+12V
5V	0V	0V	+5V
Heater	0V	0V	+6.3V
STBY 5V	0V	+5V	+5V



1. AC Input Section

The AC input section provides EMI filtering, input protection, surge limiting and CRT degauss operation.

EMI Filter
The EMI filter comprises CN600 (inlet with filter), X-capacitors C604 and C605, Y-capacitors C660 and C643 and the line filter transformer, LF602. Input protection is provided by F601and VA601; surge current limiting by thermistor TH600 and resistor R600. Degauss is explained in the next section.

Degauss Circuit
The degauss circuit is used to demagnetize the CRT. After power on, the microprocessor located on the D Board sets the degauss signal to digital high and Q601 turns on relay RY601. This allows AC current into the degaussing coil through posistor TH601. The current heats up the posistor and the resistance increases, this dampens the current in the degauss coil to nearly zero. Duration time is approximately 5-6 seconds and the microprocessor then shuts off RY601, which disconnects the degauss coil from the AC line. This operation should sufficiently demagnetize the CRT.

2. Primary Circuitry Section

IC601
The heart of the primary section is the TEA1504/N2 power supply controller, IC601. The following describes the functions of each pin.

Pin 1 – Vin: This is a MOSFET drain connection internal to IC601, which is connected directly to the DC mains voltage rail. The startup current source derives power from the DC mains via the Vin pin. It supplies current to charge the Vaux (IC supply) capacitors C616, C617 and C681 and also provides current to the IC601 control circuitry.

Pin 2 – HVS: High voltage safety spacer pin is a no connection.

Pin 3 – NC: Connected to primary side DC mains return.

Pin 4 – Driver: Outputs the pulse width modulated gate drive for switching transistor Q602. Maximum duty cycle is set internally at 80%.

Pin 5 – Isense: Provides cycle by cycle over current protection by turning off pin 4 driver output when Q602 current exceeds the current limit corresponding to 500mV at pin 5. This pin typically provides 425nS of leading edge blanking time. The threshold voltage for switch over to low frequency (low power) operation is sensed by pin 5. When the voltage sensed at pin 5 is below 165mV, IC601 transitions from operating at high frequency (56.5KHz) to low frequency (23.5KHz).

Pin 6 – Vaux: IC601 supply pin. An internal current source from IC601 charges the Vaux capacitors C616, C617 and C681 for startup. Once the Vaux capacitors are charged to the startup voltage level (11V), then IC601 starts switching pin 4 driver output. The Vaux is also supplied by an auxiliary winding from T601 on the primary side once the secondary output voltages attain their nominal operating voltage values. Pin 6 also provides under voltage lockout detection (8V) and over voltage protection (14.7V).

Pin 7 – DS: Provides the power supply for the driver output (pin 4).

Pin 8 – Iref: Controls IC601 internal bias currents, which determines the pulse width modulated switching frequencies. High frequency is 56.5KHz during active on mode. Low frequency is 23.5KHz during suspend/standby mode.

Pin 9 – Vctrl: Feedback voltage for duty cycle control.

Pin 10 – NC: No connection.

Pin 11 – Gnd: Connected to primary side DC mains return.

Pin 12 – NC: No connection.

Pin 13 – Dem: Guarantees discontinuous conduction mode operation for the power supply. Verifies that T601 is demagnetized by not activating the next gate drive pulse until the primary side auxiliary winding of T601 is lower than the threshold level of 65mV as detected at pin 13.

Pin 14 – OOB: On/Off/Burst mode input signal. A voltage greater than 2.5V enables IC601.

Operation

The power supply is a discontinuous-mode flyback converter with photocoupler feedback for regulating the secondary voltages. The PWM controls the pulse width of the gate drive.

When AC is applied to the power supply and IC601 pin 14 is greater than 2.5V, start up current is supplied though IC601 pin 1 to IC601 pin 6. Startup voltage is approximately 11V. After start up, the voltage to pin 6 and pin 7 of IC601 is supplied through D620 connected to T601 pin 1. The first mode of operation is active off mode. The output drive pulse frequency will be in burst mode operation.

When the power supply enters active on mode, the switching frequency will be 56.5KHz. The Vaux level will be approximately 12.3 volts. OVP threshold is 14.7 volts and UVLO is 8.0 volts. Therefore, if the Vaux voltage is not correct, the power supply will not operate properly.

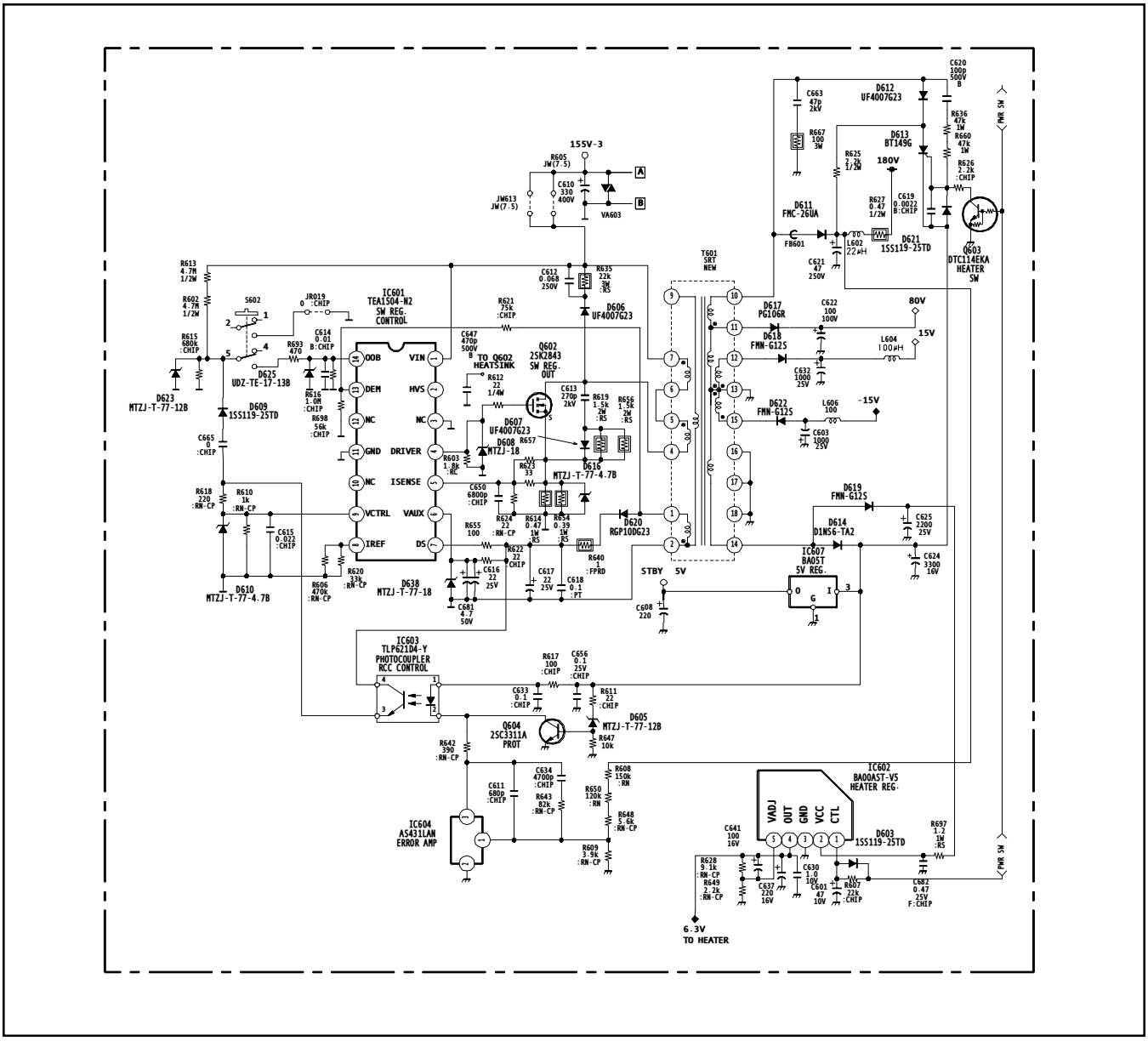
Feedback from the secondary side comes through IC603 and IC604, which is connected to IC601 pin 9. (See diagram on page 5.)

3. Secondary Circuitry Section

The secondary section consists of the following circuits: Rectifier diodes and filters for all output voltages, +5/12 volt regulators, +5 standby regulator, heater voltage regulator, voltage feedback circuit, active off mode feedback, and protection circuits. This section will describe each circuit and its function.

Secondary Rectifiers

The secondary rectifiers supply the following voltages: 180V (B+) for deflection and video, 80V for video, ±15V for deflection and regulators, 6.3V for heater regulator, and +5V standby regulator.



+5/12 Volt Regulator

IC605 is the +12V regulator and IC608 is the +5V regulator. The output voltages are supplied to the microprocessor, deflection and video circuits. The +15V line provides the input voltage for +12V regulator; the +12V line provides the input voltage for +5V regulator. During active off mode, the +12V regulator is disabled via Remote Sw and subsequently the 5V regulator is disabled.

+5V Standby Circuit

IC607 is the standby 5V regulator. In the active on mode the input to the regulator is supplied from T601 winding 14-13. During the active off mode, the regulator input is supplied from T601 winding 10-13 via D612 and D613. Typical input voltages to the regulator are active on mode: 9.5V; active off mode: 11.5V.

Heater Voltage Regulator

Heater filament voltage is supplied by T601 winding 14-13 and is regulated by IC602 to 6.3V during active on mode. IC602 output is turned on and off by the Power Sw control line at pin 1, CTL. The output is off during active off mode.

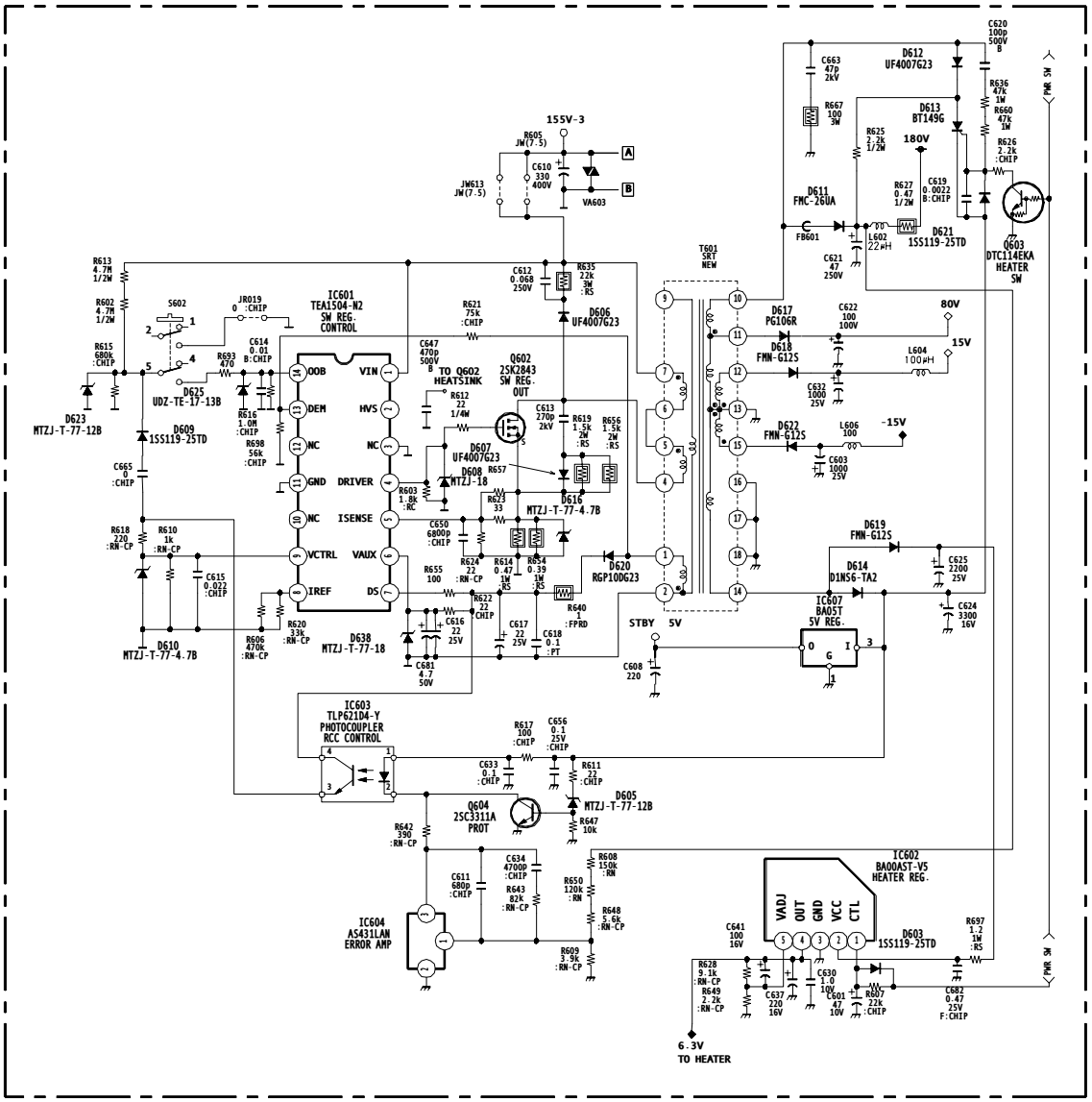
Feedback Circuit

The feedback circuit is divided into two sections. One is for active on mode; the other for active off mode. The following two sections explains the theory and operation.

Active On Mode Feedback

Shunt regulator IC604 regulates the B+ line to 179.2V by sinking current through the opto coupler 1C603 to ground. The

Feedback Circuits

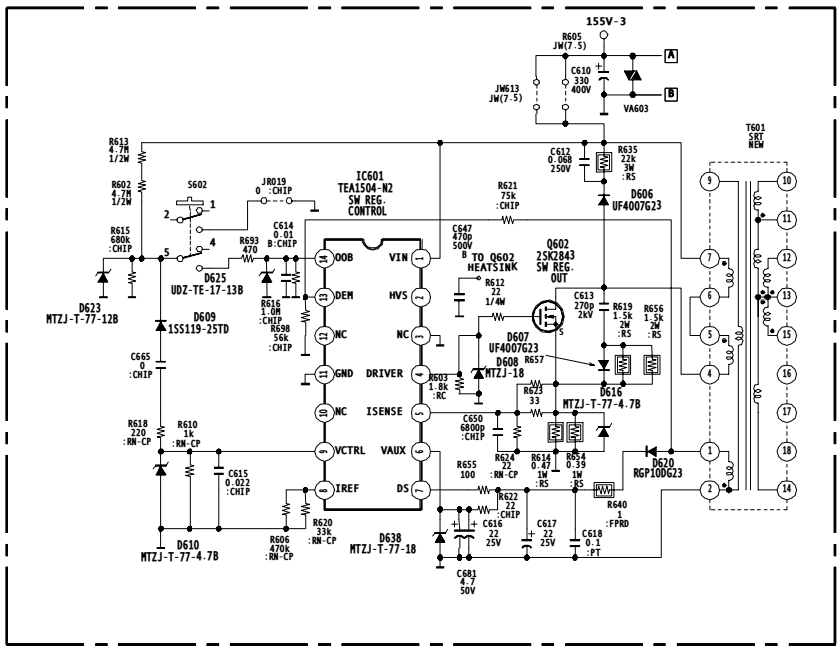


reference voltage at IC604 pin 1 determines the sink current into pin 3. The reference voltage is set to 2.5 volts by resistor divider R608, R650, R648, and R609. Since the B+ is connected to the resistor divider, any change in B+ voltage is detected at the reference terminal. The shunt regulator will either increase or decrease the current into pin 3 in order to decrease or increase the B+ voltage respectively and try to maintain the reference voltage to 2.50 volts. IC603 biases it's phototransistor accordingly and drives IC601 pin 9 (Vctrl) which changes the duty cycle at IC601 pin 4 (driver) to regulate the B+ voltage at 179.2V.

Active Off Mode Feedback

Power Sw control line is low (heater off) during active off mode and respectively Q603 is off. Voltage pulses from T601 pin 10 flow through C620, R636, and R660 triggering the gate of thyristor D613. D613 turns on effectively shorting the B+ rail to the standby 5V regulator input; current flows from T601 pin 10 through D612 and D613 to the standby 5V regulator input. When the standby 5V regulator input is increased to approximately 12.7V it forward biases zener diode D605 turning on Q604 and sinks current through IC603 to ground. The standby 5V input supplies this current to IC603 pin 1. IC603 biases it's phototransistor and drives current through D609 into IC601 pin 14 (OOB) triggering burst mode operation. IC601 pin 4 (driver) is pulled low turning off switching transistor Q602. T601 pin 1 (auxiliary winding) feedback pulses are discontinued and IC601 pin 6 (Vaux) decreases to 8V. IC601 internal current source then charges pin 6 (Vaux) to the startup voltage level (11V) which starts switching pin 4 driver output. The feedback cycle is then repeated. The burst repetition rate is approximately every 110mS and when IC601 pin 4 is switching its frequency is 23.5KHz.

Protection Circuits



4. Protection Circuits

The following are protection circuits: OCP, OVP, UVLO and secondary short circuits. OCP is pulse by pulse and is performed on the primary side. OVP detects excessive output voltages. UVLO detects output under voltages. The following will explain the operation of these functions.

OCP

OCP is activated if there is too much current passing through the switching power MOSFET, Q602. This condition will occur if either the B+ line or 80 volt line is shorted.

R614 and R654 are the current sense resistors. Current through these resistors will produce a positive voltage. R623, R624, R657 and C650 provide a voltage divider and filter to IC601 pin 5 (Isense). If the voltage level exceeds 0.5 volts, the IC does pulse by pulse current limit and the output voltages are reduced. This condition can be audible and characterized by a 'chirping' sound.

OVP and UVLO

The OVP and UVLO functions are detected by IC601 pin 6 (Vaux). Vaux is typically 12.3V. In the event the regulation control loop were to fail, the output voltages would either increase or decrease; then Vaux would increase or decrease respectively via T601 transformer coupling. IC601 pin 6 will detect an OVP at 14.7V and UVLO at 8V turning off the driver output and initiating a low dissipation safe-restart mode.

Secondary Short Circuits

Safe operation during secondary short circuits is provided by the demag function of IC601 pin 13. Demag protection reduces the switching frequency, thereby reducing the input power level and providing safe operation. Demag also provides a soft start function during startup gradually increasing the switching frequency until fixed frequency operation is attained.

5. Troubleshooting

Warning

Before attempting to fix the power supply, safety should be considered first. Never connect test probes to the primary side circuits, unless proper isolation has been installed. If isolation for the AC mains is not present, serious harm can occur. Never assume you are safe.

Caution: C610 has a Slow Voltage Discharge
If the front panel power on/off button is switched to the off position prior to the AC mains input power being removed from the monitor, then electrolytic capacitor C610 discharges with a long time constant. When the monitor cabinet cover and/or EMI shield are removed, making the D board circuitry accessible during servicing or repair by qualified personnel, the following procedure is recommended: Always remove the AC mains input power from the monitor prior to switching the front panel on/off button to the off position. The AC mains input power should be removed from the monitor for a minimum of 30 seconds before the front panel on/off button is switched to the off position.

Caution: Do NOT Touch IC610 Component Tab or Heat Sink
IC610 component tab has an electrical voltage potential equivalent to the primary side return (approximately AC mains input voltage potential). If IC610 heat sink insulator pad and/or shoulder washer busing are damaged or not assembled correctly, then the IC610 heat sink will have an electrical voltage potential equivalent to primary side return (approximately AC mains input voltage potential).

No Power
In the event that the monitor does not turn on, first verify input power is applied to CN600 and the front panel power button is turned on; then check F601. If F601 is blown, the primary side circuitry should be checked. If the fuse is not blown, then check the secondary side circuitry, especially the protection circuits. If these circuits are causing a no power symptom, the problem can be more readily found.

AC Input and Degauss Circuit Trouble Shooting
For no power or nonoperating power supply, the AC input circuitry should be checked. Open or short circuit elements will cause non-operation. Check F601, CN600, D601, R600, TH600 and R605 on the D Board. Check the front panel power button for continuity.

If all elements are correct, check whether F601 breaks when power is applied and the power button is closed. If the fuse does blow, there probably is a component shorted in the prmary circuitry.

The degauss will malfunction if CN601 is not connected. One problem could be loss of degauss signal from the microprocessor. This can be verified by using the manual degauss command found in the OSD menu. If the signal does not appear at Q601 base, then it is possible that the microprocessor does not function correctly or standby 5V is not functioning.

The second step is to place a short across the AC terminals of RY601 for less than two seconds. If degauss operates then check Q601 and RY601. If degauss does not work, check TH601 for an open condition and C631 for a short condition.

Primary Section
Three main areas can diagnose primary circuit failures. These are IC601, Q602 and Feedback system.
Visible checks of these areas will aid in finding problems. The following will discuss each section.

IC601
First apply AC to the monitor and check IC601 pin 4 output. If the output on pin 4 is not present, there could be problems with Q602 and related parts or pin 14 could be less than 2.5 volts. Further, check Vaux level at pin 6. If it less than 11V, the IC could be in safe-restart mode. If the voltage is very low, there could be a short on any of the IC pins. In reference to ground, check the impedance of pin 1, 8 and 14. If any of these pins are shorted, replace the IC and check components connected to the related pins. Take care that C616, C617 and C681 are fully discharged before replacing the IC.

Q602
The switching transistor can be damaged in various ways. These are related to voltage, current and temperature.

Check whether the transistor is shorted across drain and source terminals. If there is a short, F601, R605, R614, R654, R623, R624, R657 and C650 should be checked. Additional components to check are D608, R603, R612 and IC601. If Q602 is shorted, all these parts should be replaced.

Failure of a secondary rectifier diode can also cause Q602 to fail. Check 180V and 80V diodes for open or short conditions. There is also a clamp circuit, which is used to clip the turn off spike found on Q602 drain. If the clamp circuit is broken, it can cause Q602 failures. Check D606, C612 and R635. Also check the snubber circuit components C613, D607, R619 and R656.

Secondary Circuit
Failure in the secondary circuits can be categorized by rectifier diodes, regulators, feedback loops and protection circuits.

These sections are interrelated and failure in one can affect another. Consequently, some failures will also affect the primary circuitry.

Rectifier Section
Rectifier diode failures are not common, but do occur. Deflection, video and high voltage circuitry failures contribute to diode damage. In the event a voltage is not present, check for shorts to ground, open or short diodes.

+5/12 Volt Regulator
If +12V or +5V output line is not available or the wrong voltage, IC605 or IC608 may be damaged. Before replacing either IC, check for shorts or damaged parts along the output lines. If +12 volt does not appear, check the Remote Sw signal from IC901 pin 6.

Standby 5V Circuit
Failure of this circuit can be affected by IC607. In case the circuit does not work properly, check D605, D614, R611 and Q604. If these components are good, check the remaining circuit parts. Another possible influence can be the heater circuit. Since both the standby 5V and heater voltages are produced by T6-1 winding 13-14.

Heater Voltage Regulator
This circuit may be affected by R697 or D619. If these parts are good, check the regulator output for a short to ground. Shorts can occur on the video board. In the case of Power Sw signal.

Feedback Circuit
Problems with feed back can cause power supply shut down and low or high output voltages. First determine whether the power supply is operating in active off, active on modes or not at all.

The power supply can be stuck in active off mode. The Remote Sw signal, Q603, Q604, D605 and IC603 can affect this condition. Likewise, if the power supply is always in active on mode, the same items should be checked, along with D612, D613, D621, C619, C620, R626, R636 and R660.

Checking for voltages at IC603 pins 1 and 2, IC604 pins 1 and 3 can solve more difficult problems. Additionally, IC603 pins 3 and 4, and IC601 pin 9 should be checked. If there are problems with these devices, 180V or standby 5V line, the feedback systems will not work correctly. Also check the protection circuits.

Protection Circuits
OCP occurs when there is excessive current through Q602. Failures with Q510, Q507 or the video section could cause this condition. These areas should be checked. OCP condition can also occur if R614 or R654 are open; if R623 or R657 are shorted; or if R624 is open.

OVP usually occurs when the feedback loop is open, or loss of standby 5V. Isolate the OVP trigger condition, by first checking the operation of the feedback loop.

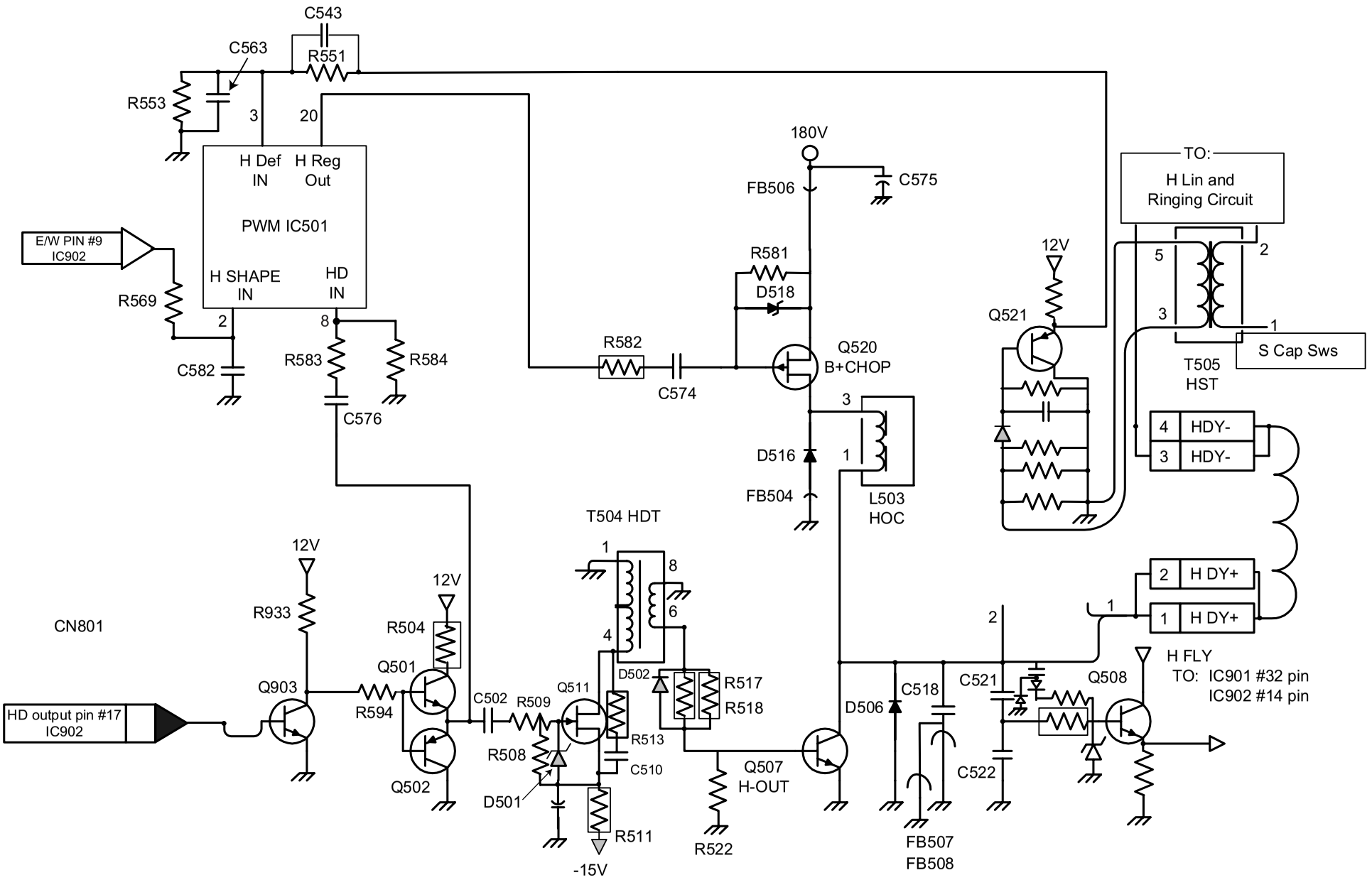
6. USB/Audio Power Circuit

CAUTION: Do not touch IC610 component tab or heat sink. The IC610 component tab has an electrical voltage potential equivalent to the primary side return (approximately AC mains voltage potential). If the IC610 heat sink insulator pad and/or shoulder washer bushing are damaged or not assembled correctly, then the IC610 heat sink will have an electrical voltage potential equivalent to the primary side return (approximately AC mains voltage potential).

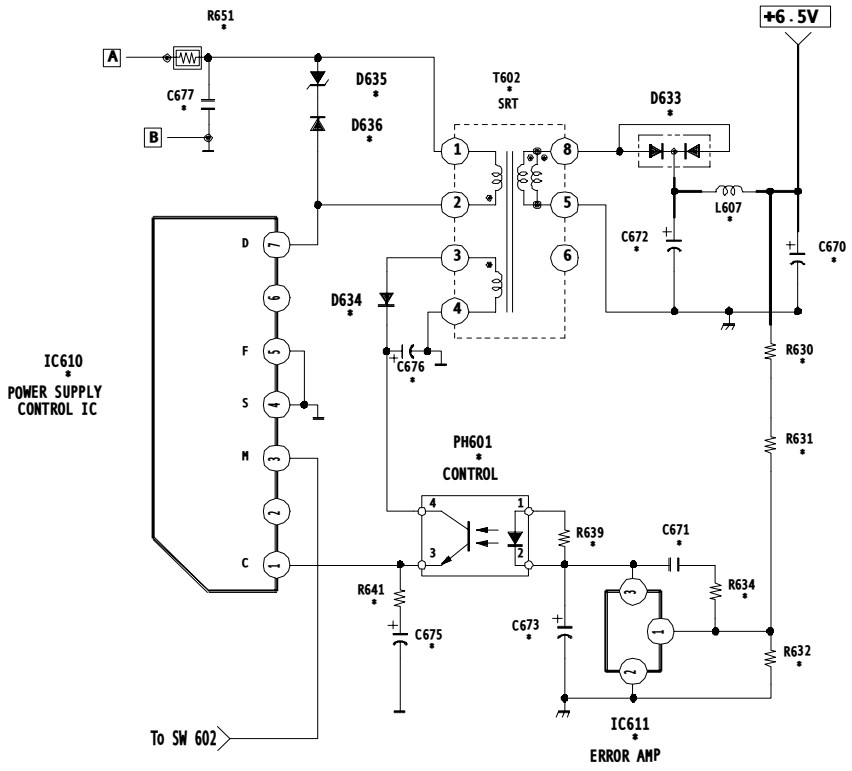
The USB/Audio power supply circuit is a flyback converter that uses an integrated power mosfet and switch mode pwm control IC (IC610). The circuit consists of IC610, T602, D633, PH601, IC611 and associated circuitry. Start up is initiated when C675, connected to the CONTROL pin 1 is charged via a high voltage current source internal to IC610. When CONTROL pin 1 reaches 5.8V, the control circuitry and mosfet are activated and a 10mS soft-start begins. The typical mosfet DRAIN pin 7 switching frequency is 130 KHz with a ±4KHz jitter. The feedback loop consists of shunt regulator IC611 and optocoupler PH601 that will regulate the secondary side output voltage at 6.5V and provide feedback current to CONTROL pin 1. During normal operation, T602 bias winding pins 3-4 provide the charging current to maintain CONTROL pin 1 at 5.8V; additionally the CONTROL pin 1 charging current that is regulated by IC611 and PH601 controls the mosfet duty cycle to provide closed loop regulation.

The front panel power button controls the on/off function for the USB/Audio power circuit. When the power button is in the OFF position, the MULTIFUNCTION pin 3 is shorted to CONTROL pin 1, turning off the power circuit. When the power button is in the ON position, the MULTIFUNCTION pin 3 is shorted to primary side DC mains return, which enables the power circuit.

H Deflection Circuit



USB/Audio Power Circuit



A voltage clamp to limit the peak voltage on DRAIN pin 7 is provided by D635 and D636. Bypass capacitor C677 is utilized to improve high frequency noise immunity.

IC610 provides the following protection functions: a 10mS soft-start function, a cycle-by-cycle peak current limit function, a shutdown/auto-restart function if an out of regulation condition occurs and an over temperature protection function.

D BOARD DEFLECTION SECTION

1. Horizontal Deflection Circuit

Overview

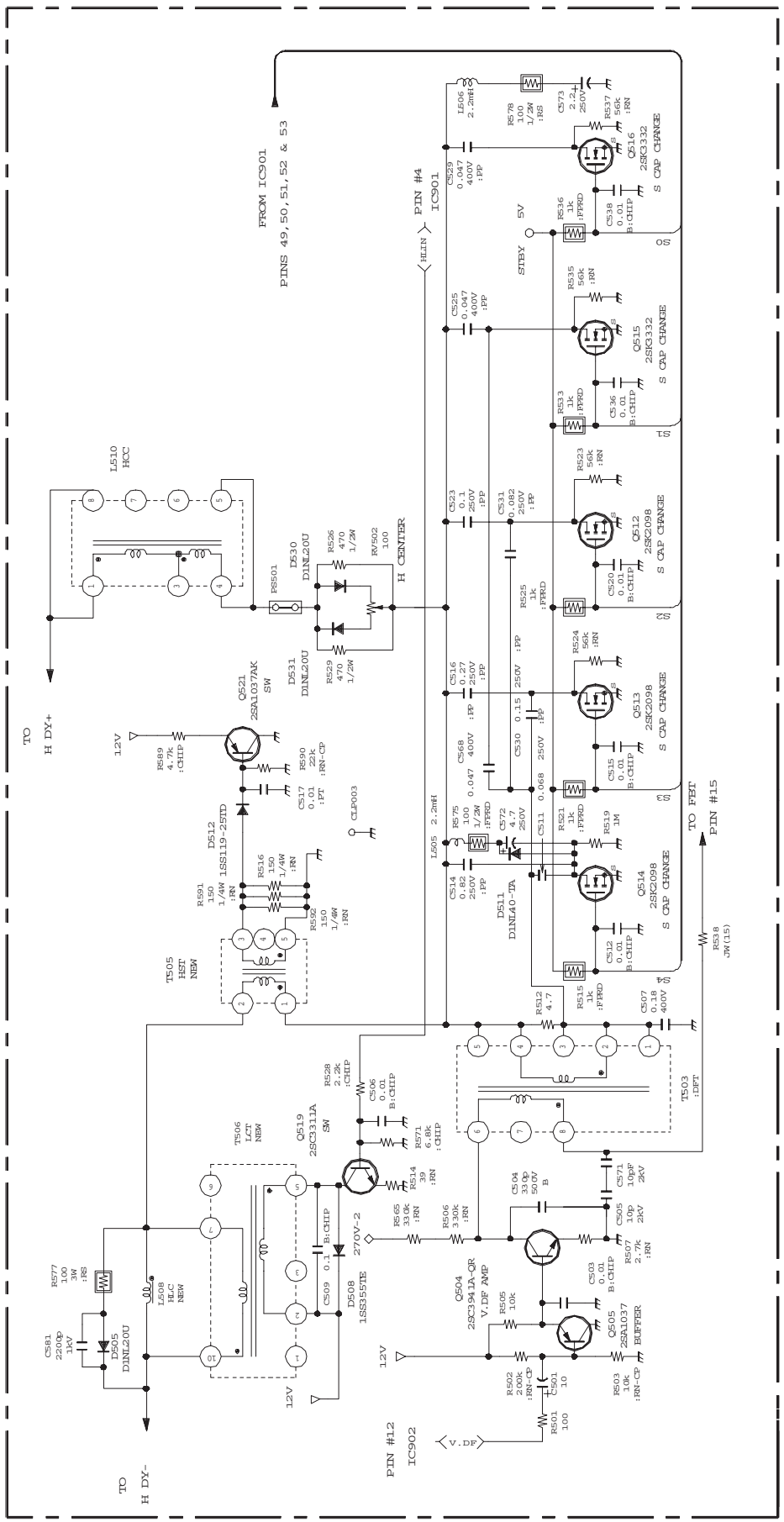
These circuit drive the DY (Deflection Yoke) for Horizontal Deflection. The H size and H shape control (IC501 and around) is included in this page as well.

H Drive, H Out, Feedback

+12Vp-p HD pulse is generated by the inverter Q903 using the Jungle IC902 H. out pin #17. And switch Q511 through A push-pull amplifier (Q501 and Q502) buffers. The drive current which introduced in HDT (T504) by this switching will drive Q507 (H out Tr) and 1000V pulse appears on collector. D506 is the "Damper Diode" which avoid the negative pulse and discharge the energy for next Horizontal Drive. Q508 is the buffer for the "H BLK" feed back to Jungle IC 902 H. FLY pin #14 and it will be the reference of phase / jitter control of Jungle. HST (T505) is to sense the deflection current through DY. The voltage appeared on secondary side will be the feed back for H Size/Shape control.

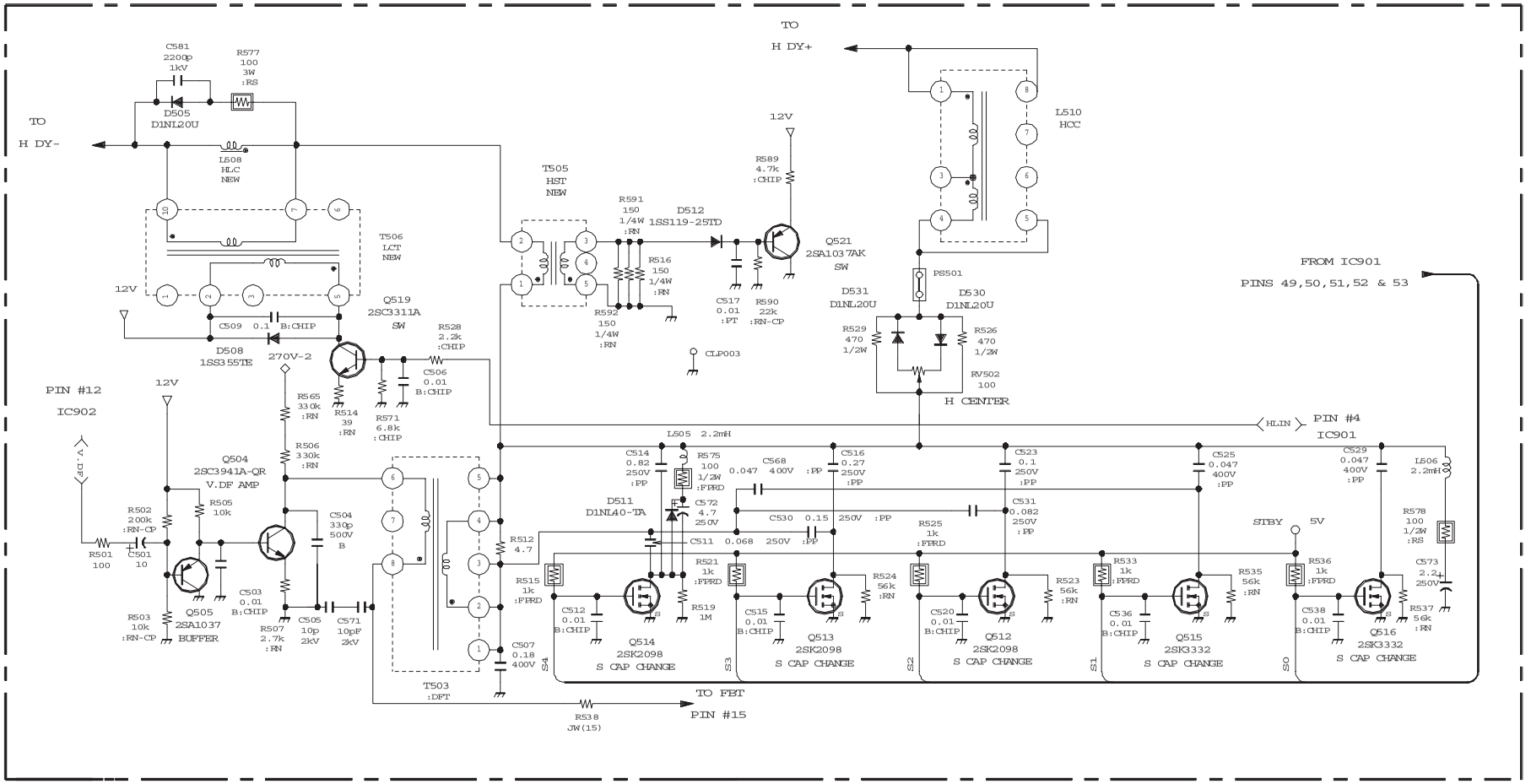
H Size/Shape control

HD pulse also triggering the H Size/Shape control IC501 pin #8. IC501 is "PWM IC" and it controls H and HV B+ chopper duty. H Shape and H size information is already included and coming from Jungle IC902 E/W pin #9. It will be supplied to IC501 pin #2. H reg output pin #20 is switching pulse of Q520 (B+ chopper). The energy supplement from 180V to H Def circuit (through L503 HOT) is controlled by the duty of this pulse. The H Shape input and feedback voltage from T505 are compared by error amp (in IC501) and H Reg out pulse duty is controlled to keep the level of these two the same.



D (BOARD)

H. LINEARITY AND RASTER DISTORTION CORRECTION CIRCUIT



D (BOARD)

(17VC H. CENTERING CIRCUIT)

Troubleshooting
See attached "FLOW CHART" and confirm if it's really an H Deflection issue.

No H Deflection / No Power
Check Q507, Q520 and D506 first. In case any of these shorted, check T504, Q511, R511 and D502.
Those parts might have been damaged.
If both of Q507, 520 were not broken, check the HD pulse at the gate of Q511.
If no pulse, check Q501, Q502, Q903.
Otherwise, check R582, D518 or try changing IC501.

Bad Distortion
Check pin#2 of IC501 and confirm that proper DC level and AC waveform.
If the distortion is on only right side, check all above ("No H Deflection").
Otherwise, refer to the Troubleshooting of next section ("H Lin and Ringing Correction").

2. H Linearity and Raster/Distortion Ringing Correction Circuit

This section includes HLC Control circuit, S cap switching and HLC/S-Cap Damping circuits. These circuits are placed directly on the "cool side" of DY which is in series with deflection current line. H Centering circuit will be explained in next section.

HLC Balance Control and HLC Damping
HLC (L508) effectiveness is changed by LCT (T506) for each fH since T506 and L508 are in parallel. LCT is the Cross Transformer that can change its inductance accordingly to the DC current of the secondary side. The current of the secondary side is controlled by the DAC output of Micro (IC901 - pin 4) through Q519. It can be changed by the register "HLIN_BAL_LOFH", "HLIN_BAL_MDFH" and "HLIN_BAL_HIFH". D505, C581 and R577 make up the damping circuit to avoid Raster Ringing (mainly on the left side of the picture) caused by HLC, DY and S-caps.

S-Cap switching and S-cap Damping
H Def current is distorted by resonance between S-Cap and DY to correct the linearity. Since the resonance frequency has to be changed for each fH, S-Cap switching is controlled by MICRO
S-Cap Switch - FETs (Q512, Q513, Q514, Q515, Q516) are "On" when its gate is Hi(5V) and that moment, drain voltage should be grounded (0V).

L506, R578 and C573 is damping circuit to avoid Distortion Ringing (mainly on top of the picture) caused by S-caps and H Control loop gain. L505, R575 and C572 is also the same purpose as above but only works when Q514 (Switch for the Biggest S-Cap) is "On".

Troubleshooting
See attached "FLOW CHART" and confirm if it's really H lin issue.

Bad Linearity
Confirm that Raster is approximately in the center of the Bezel. If not, refer to next section (Raster Centering Circuit).
Check S-cap switches (Q512, 513, 514, 515, 516, HLC switch (Q519)) and confirm that H Linearity changes proportional to the value of "S-Cap" DAC. Confirm that H.LIN BAL changes by the register value of "HLIN_BAL_LOFH", "HLIN_BAL_MDFH" and "HLIN_BAL_HIFH". If not working, check Q519, C508 or T506.

Bad Top Distortion/ Left side Raster Ringing
Check damping circuits explained above.

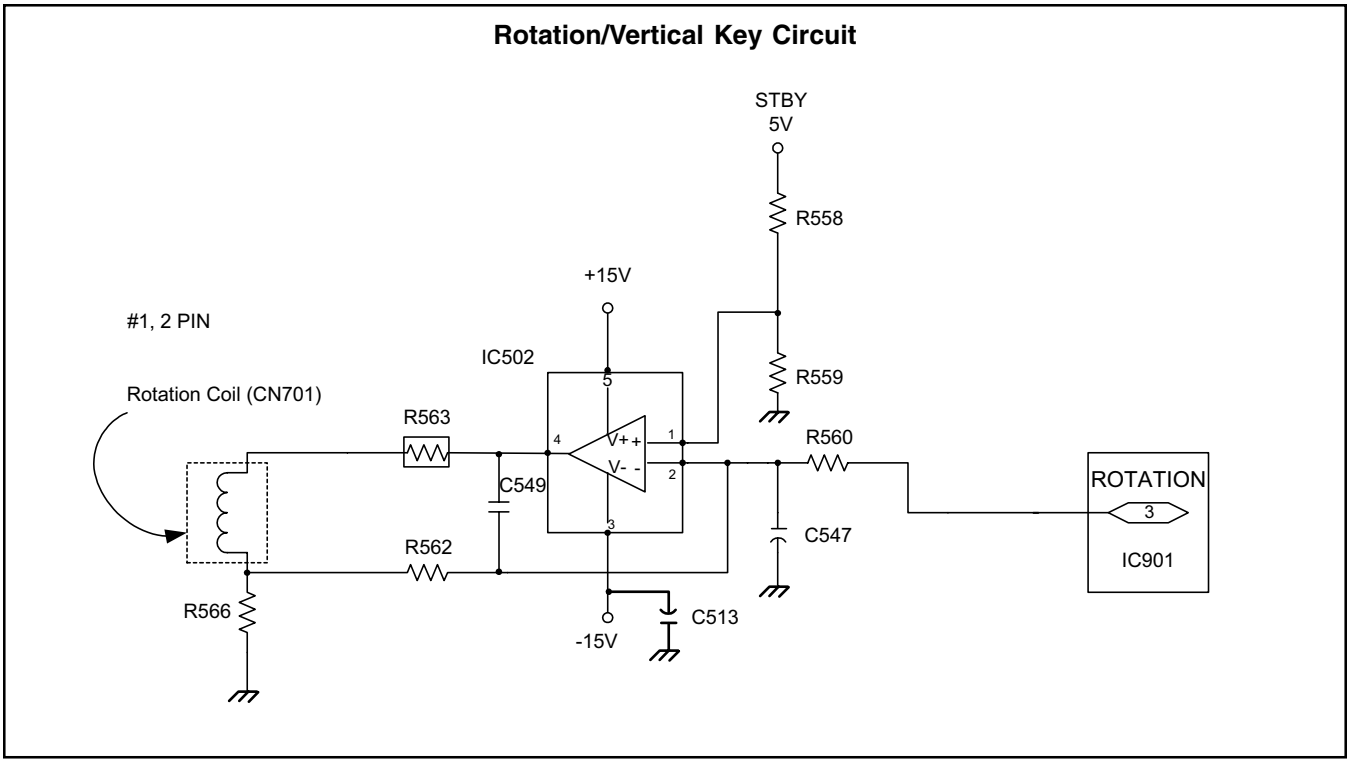
3. H. Raster Centering Circuit

Overview
H center circuit is changed from D99 type in which the Power OP-Amp is used

H Center Circuit
H Centering is changed by rotating RV502 to change the current through HCC (L510). Micro is no longer controlled.

Troubleshooting
See attached "FLOW CHART" and confirm if it's really H Center Circuit issue.

No Raster Centering Control
Check R526, R529 and L510 first. Then, check D530, and D531. If these parts are good, check RV502.



4. Rotation Circuit

Rotation is a PWM waveform at approximately 125kHz measuring 5Vp-p at pin #3 of the micorprocessor IC901. Then filtered by R560 and C547 combination. The DC current is output by powered OP-amp (IC502). The output current from pin #4 of IC502 flows through R563 and the rotation coil and returns to ground through R566. The feedback is sensed at R566 and sent back to the amplifier through R562.

No Rotation Control
Check the waveform pin #3 of microprocessor IC901 if it is 5Vp-p PWM and approximately 125kHz. Otherwise, check around IC502.

5. Dynamic Focus Circuit

Overview
Both H and V Dynamic Focus are combined through DFT (T503).

H DF
Horizontal Parabola is injected into the secondary side of the focus transformer (DFT:T503). In order to keep the amount of parabola constant over the horizontal frequency range the values of the AC coupling capacitors are changed by the transistors, which switch the s-caps. This signal is amplified by the turns-ratio to the primary side of the transformer.

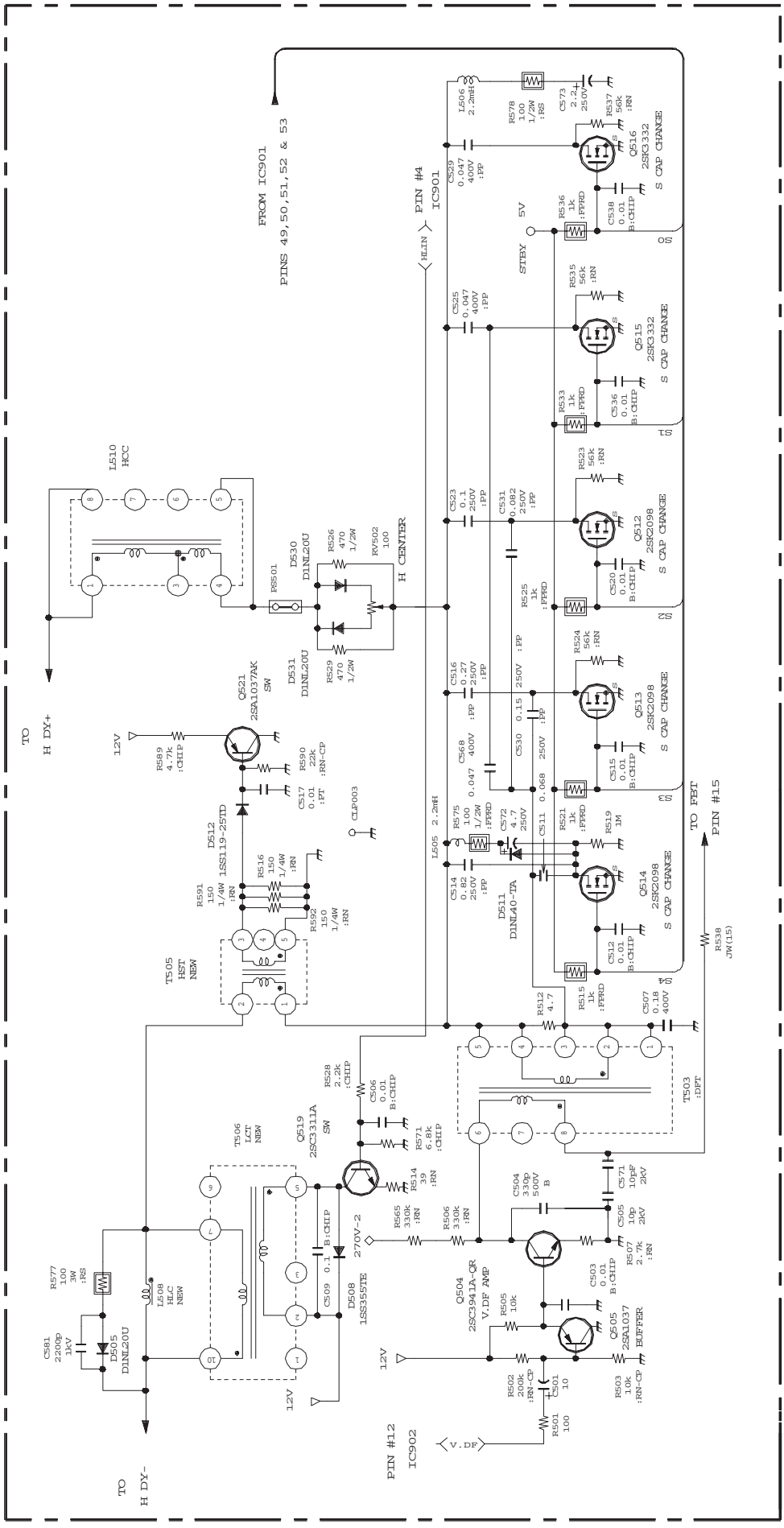
V DF
V DF waveform is buffered by Q505 and amplified by Q504 to about 130Vp-p. VDF is controlled by Jungle IC902 pin #12. 300v Vcc is made by FBT through D515. This voltage is also used for HV Protector.

Troubleshooting
See attached "FLOW CHART" and confirm if it is really a DF issue.

Bad H DF
Check H. Linearity. If there is no problem, change T503 (DFT).

Bad V DF
Confirm that waveform is around 1Vp-p from Jungle pin 12 of IC902. If it's more than 2.0Vp-p, change Jungle IC902. Check 300v from FBT.

Dynamic Focus Circuit



6. High Voltage Protect Circuit

This circuit generates the High Voltage supply for the anode. It consists of a high voltage driver and regulator similar to a switching power supply function. In addition, there are High Voltage and Beam Current protection circuits. All those circuits are similar to D99 chassis circuits.

High Voltage Regulation and Output Circuit

The HV Drive pulse is generated by IC501 and synchronized with Horizontal drive pulse. It is supplied to the Gate of Q510 the HV Out FET.

The HV Out Pulse approximately 700V, is generated by Q510 switching with the peak voltage being controlled by the switching duty of Q503 (B+ chopper). Internal resistors and R540 and RV501 divide HV generated in the FBT. Since this voltage is the feedback for HV Regulation control. Adjusting RV501 will result in changing the HV Regulation level(= HV level). HV Feedback voltage is returned to IC501 at pin#12 to be compared with an internal reference voltage of IC501 at pin#13. According to this feedback level, IC501 changes the pulse duty cycle. This pulse is felt at pin #18 of IC501 thereby controlling the output of B+ chopper drive Q503.

G1 Voltage (-33Vdc)

D510 and C528 through R532 rectify -57Vdc developed by a -57V winding of FBT. It is then regulated by D503 and C533 to be -33Vdc typ through R539. -33Vdc is supplied through R570 to the A Board via CN510.

HV Protect Circuit

HV Protect circuit will be activated by the Microprocessor when the signal at HV DET, Microprocessor pins#18 reaches a +5vdc level. HV DET indicates the level of the primary current developed by the 270V winding of the FBT through R543, D515.

Beam Current Protect

Beam Current Protect will be activated when ABL DET at microprocessor pin#16 reaches a level of 0V when operating in main mode. ABL DET level is corresponding to the Beam Current which is supplied to FBT through R596, R550 and R548. The voltage current relationship is inversely proportional Voltage (down) Current (up).

Troubleshooting Hints

See attached FLOW CHART to confirm if is really an HV/Protect Circuit issue.

No HV / No Power

Perform basic checks of Q510 and Q503 first. If both Q510 and Q503 were not broken, check the HV Drive pulse at the gate of Q503. If no pulse, check R534 and D509. Otherwise, check R520, D504 or try changing IC501.

No G1 Voltage

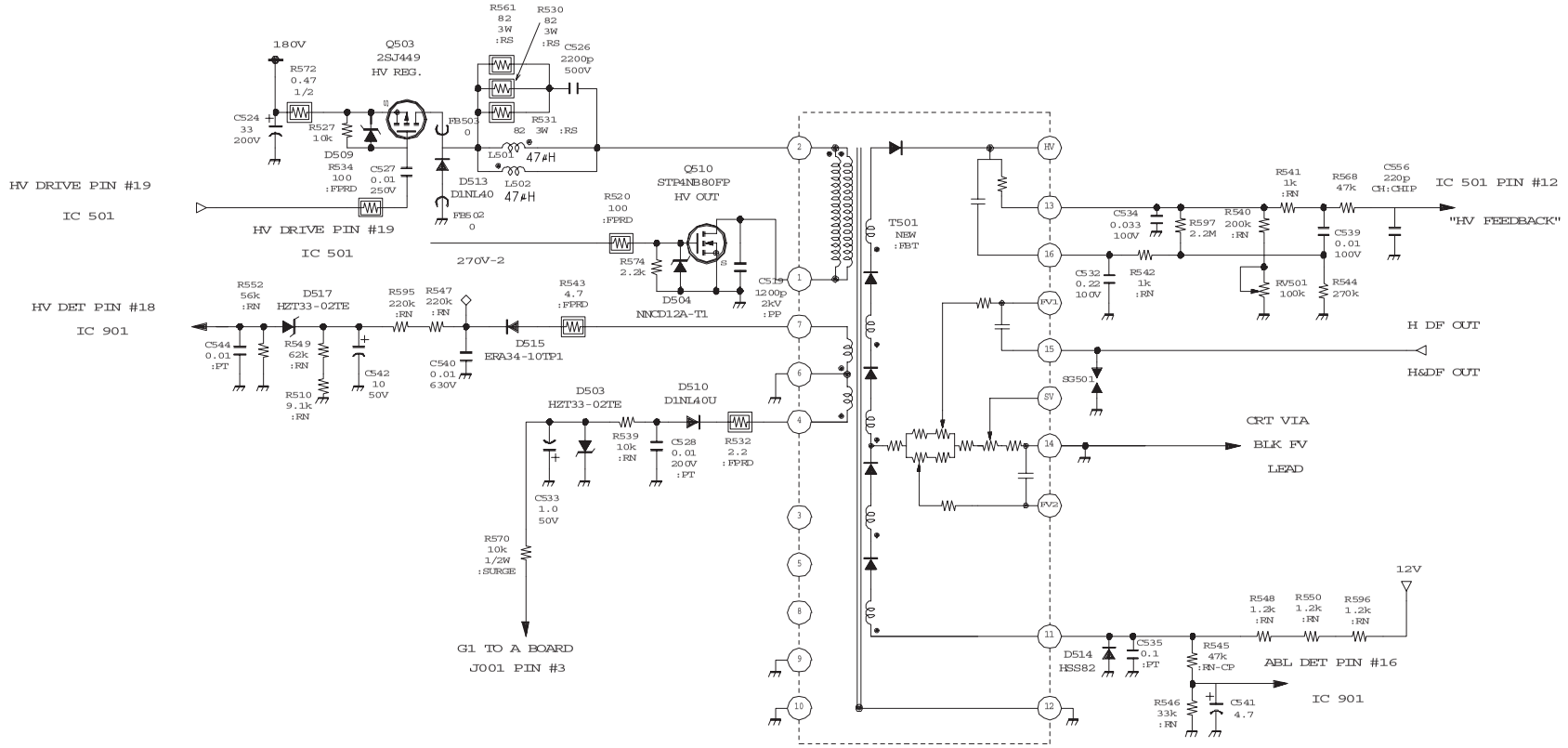
Check R532, D503 and D510

Protect Malfunction

To see if HV Prot or ABL Prot are suspect check the Shutdown Log data at the Shutdown Log register. Refer to Shutdown Log Table below.
When an HV Shutdown is indicated, check R917, R921, R543, D515 and D517 or, replace T501 (FBT).
Where ABL Shutdown is indicated, check the voltage T901 pin#11.
If it is higher than 0.5v immediately prior to shutdown. Should the voltage reach and remain at the 0 volt level, even after the first 2.0 seconds of Power On, check D514 or check White Balance.

SHUTDOWN LOG TABLE

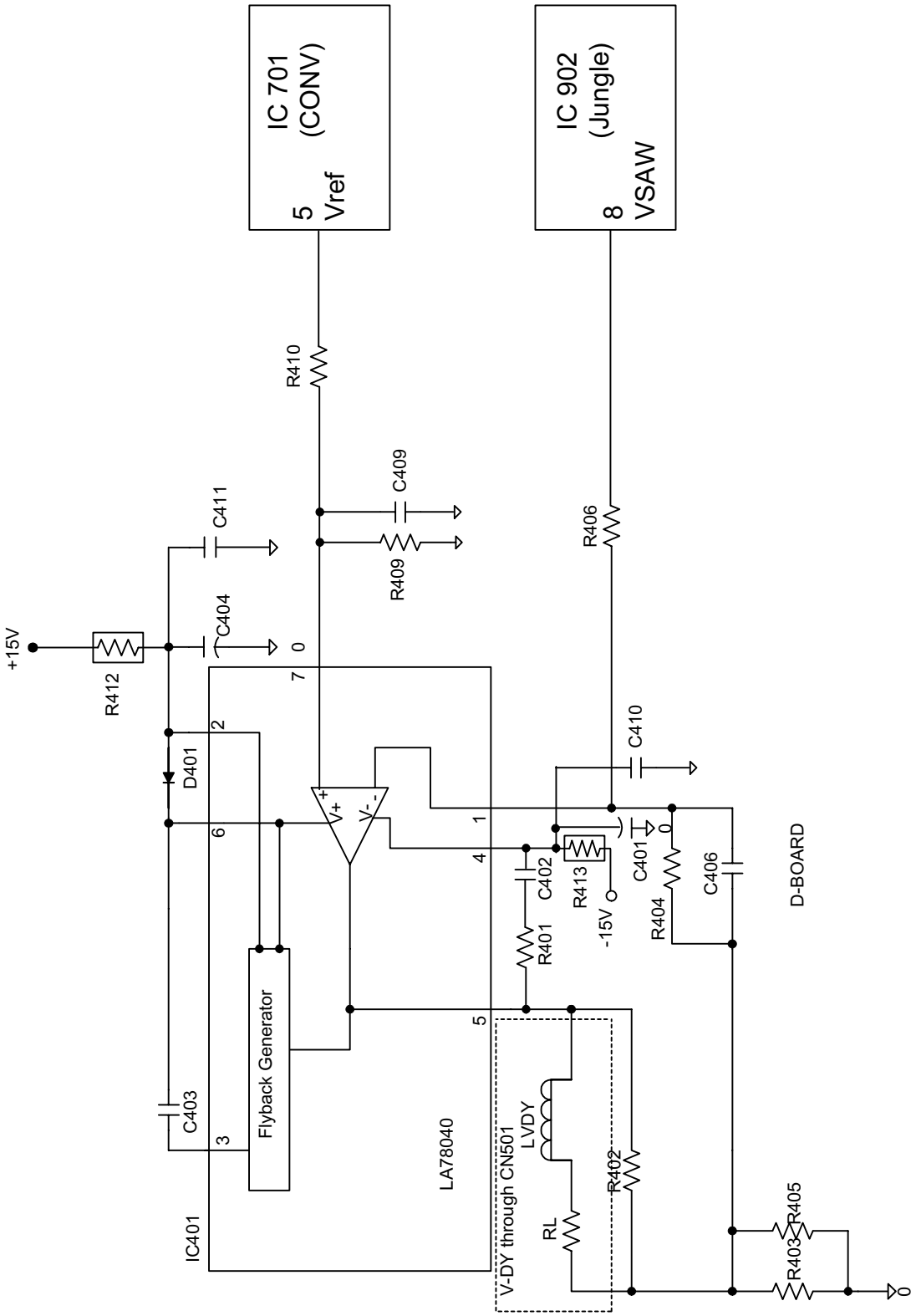
Bit	Register value	Shutdown Mode	Comment
bit7	128	N/A	N/A
bit6	64	N/A	N/A
bit5	32	S Cap Shutdown	Explained later
bit4	16	ABL Shutdown	Hardware Controlled
bit3	8	HV Over	Hardware Controlled
bit2	4	HV U Shutdown	Not Used
bit1	2	No Vertical Scan	Explained later
bit0	1	No H Scan	Explained later

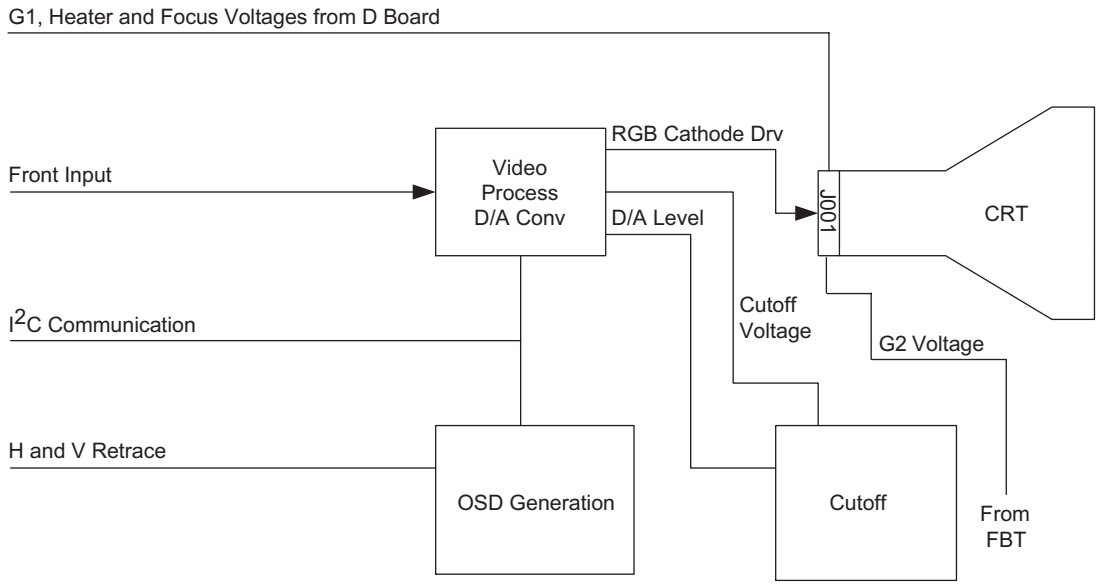


D (BOARD)

17VC CHASSIS HV/PROTECTOR CIRCUIT

Vertical Deflection Circuit





17VC Chassis A Board Block Diagram

7. Protection Circuitry Overview

Overview

The 17VC chassis was developed with protection circuits other than HV/ABL.These protection circuits are controlled by Microprocessor (IC901); All of these circuits are similar to the D99 Chassis.

- S Cap Shutdown: Activates when S-Cap Switch in FET are broken.
- V Scan Shutdown: Activates when Vertical Deflection signal is absent or of insufficient level or of a distorted nature.
- H Scan Shutdown: Activates when Horizontal Deflection signal is absent or of insufficient level or of a distorted nature.

Troubleshooting Hints

S Cap Switch Shutdown

In the event of failure of any S-Cap Switching FETs, and "POWER_SW" or AC Power Switch was turned off/on, the microprocessor detects FET Gate damage and goes into shutdown mode. For these conditions, refer to the section of H Linearity Circuit.

Vertical Scan Shutdown

If the V FLY feedback at pin #19 the Microprocessor doesn't get pulse around 1.5 second, a Shutdown will be initiated. Power Supply problems may also produce a similar type failure. For these conditions, refer to the V Deflection Circuit or the Power Supply section.

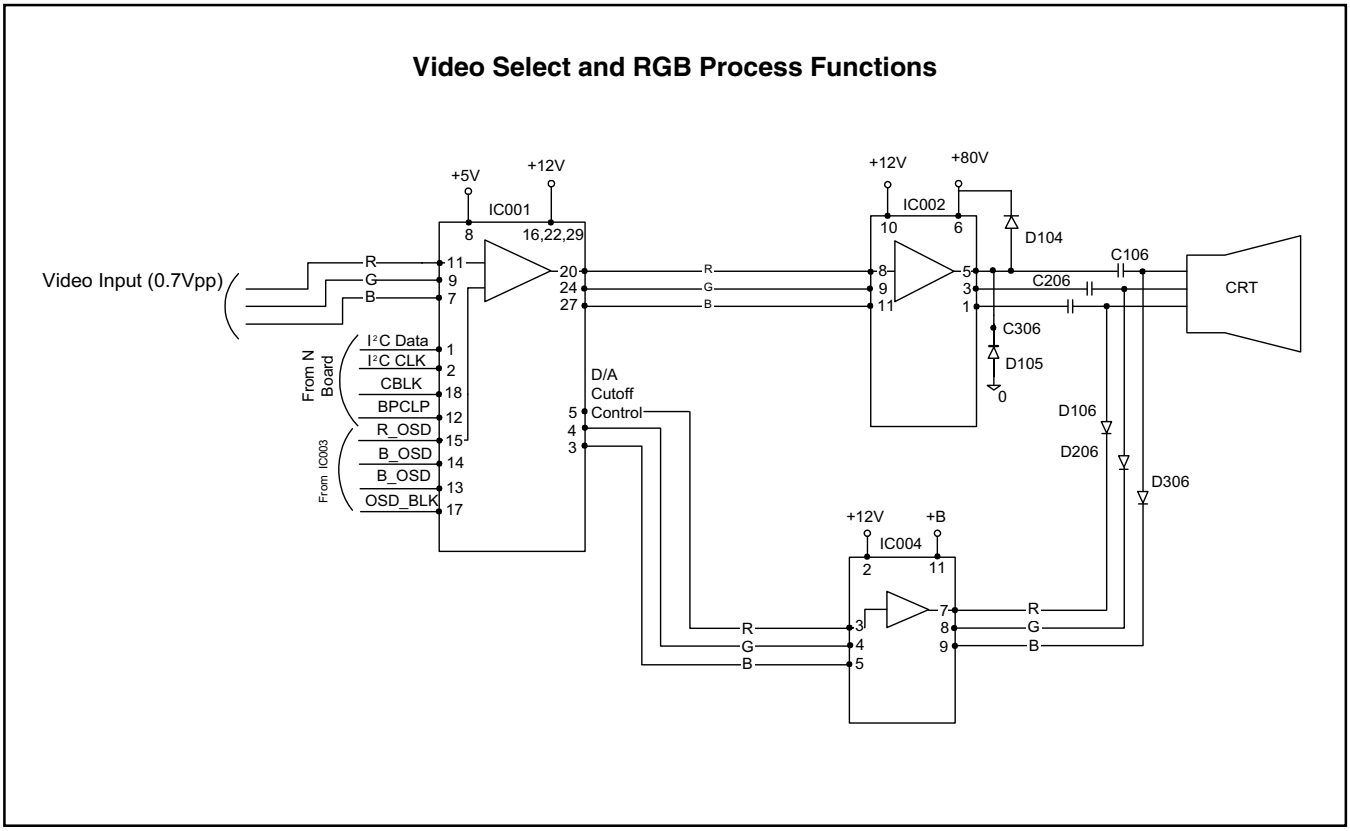
Horizontal Scan Shutdown

If the H FLY feedback at pin #32 of the Microprocessor doesn't get pulse around 500mSec, Shutdown will be initiated. Some power Supply problems may also produce a similar type failure. For these conditions, refer to the H Deflection Circuit or Power Supply sections.

8. Vertical Deflection Circuit

Theory of Operation

The negative input of amplifier IC401 is driven by VSAW signal generated by Jungle IC902 pin #8. The positive input of the amplifier is Vref Signal generated by IC701 (Convergence IC) pin #5. VSAW is centered on 5. 0V, and sawtooth waveform that controls VSIZE. Vref is a reference that is compared to VSAW at IC401. VCENTER is controlled by the shift of



VSAW. IC401 serves as a transconductance amplifier (it amplifies a low level voltage into a high level current) for VSAW and the DC difference between VSAW and Vref. The current gnerated by IC401 is feed to the Vertical Deflection Coil. At the return point of the Vertical Deflection Coil the current flows through R403 and R405 which generates a voltage across them which is feed back to the amplifier via R404.
V FLY is generated by flyback pulse generated at pin 3 of IC401. If the flyback generation at IC401 does not work, then the monitor will go into shutdown as a V scan failure by the microprocessor after wait approximately 1.5 sec without VFLY.

Troubleshooting Hints

Vertical Scan Failure

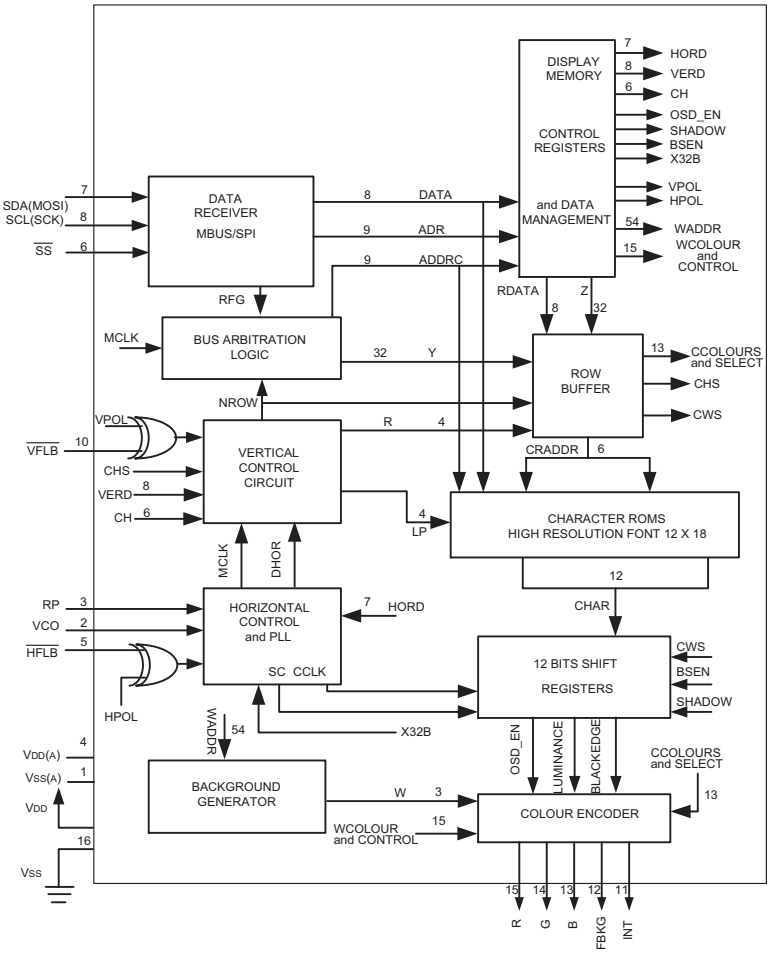
The first step is to check the shutdown log of the monitor and make sure the microprocessor has detected a loss of VFLY. Once this has been verified the output of IC401 should be checked. If a normal output exists after the "POWER_SW" is turned on but the monitor still shuts down then the VFB detection circuit is malfunctioning. If no output exists signal tracing should begin at IC902 pin #8 (VSAW) and IC701 pin 5 (Vref). In shutdown mode both of these levels should be 5.0V DC. If the "POWER_SW" is turned on a sawtooth waveform of about 1Vpk-pk should appear on VSAW while DCC stays at 5.0V this should last about 1.5 seconds until a loss of VFLY is detected and the monitor shuts down again. If the signals make it this far, the problem is likely in the IC401 area.

VIDEO "A" BOARD ELECTRICAL CIRCUIT

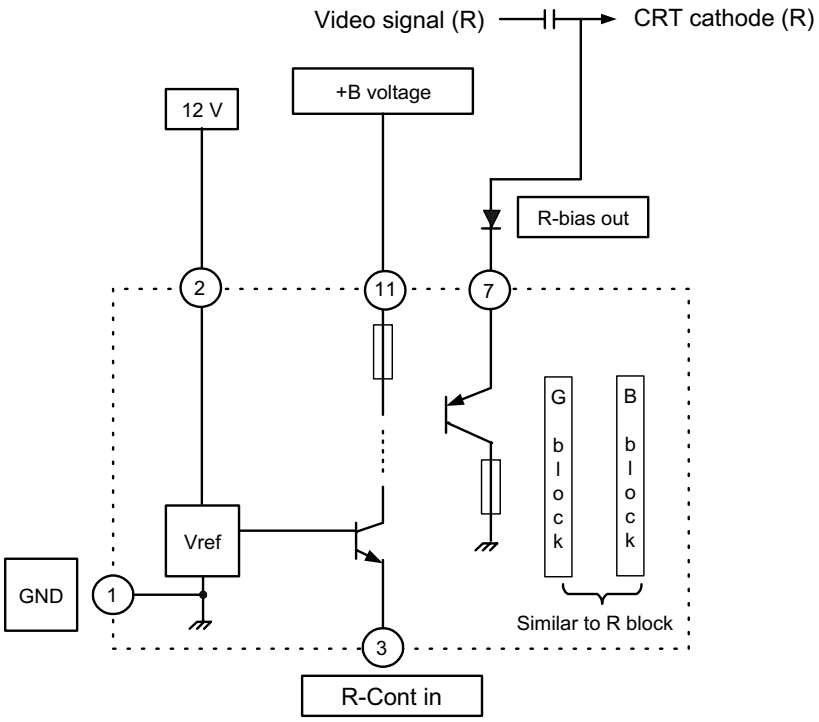
The Main function of the A Board is to receive incoming video signals and then process them into the RGB video drives necessary for proper CRT biasing. The input signals (RGB) are received with the conventional 15 D-sub connector. The RGB signals (0.7Vpp) are sent to the preamplifier (IC001) where they are amplified with Contrast gain and Brightness offset. Next they are sent to the Video Driver for final amplication to drive the cathodes. IC003 is the On Screen Display (OSD) generator. OSD mixing is performed in IC001. Additional functionalities of the A Board include processing of all the CRT cathodes operating voltages; heater, G2, cathode DC bias, and focus.

- Sync on Green Buffering.
- RGB video signal amplification and adjustment according to white balance requirements, contrast and brightness settings.
- On Screen Display mixing.
- D/A conversion for RGB CRT cathode cutoff levels control.

Block Diagram IC003 OSD



Block Diagram IC004 Cut-off Module



1. RGB Signal Processing (A Board)

RGB Signal Amplifiers

RGB video signals are amplified by IC001. Here the individual Sub Contrasts, Brightness offsets, and Contrast gain levels are set by the Microprocessor via I2 C control. The OSD RGB video signals from IC003 are mixed into the main video channels inside IC001. IC002 provides a final amplifier stage for the RGB video signals. This video driver is internally set to a gain of –14. Therefore at the output pins of IC002 (Pin1, 3 & 5) the waveform is inverted with typical drives levels on the order of 45Vpp. The Video Driver IC002 drives the CRT cathodes via AC coupling.

RGB Cathode Cutoff Amplifiers

The Red cathode DC cutoff level is amplified by IC004. It is controlled by the D/A output of IC001. The Red cutoff level is clamped by discharging C106 via D106. The Green and Blue cathode Cutoff levels are clamped in a similar fashion. The individual cathode cutoff levels are set for white balance by the Microprocessor via I2C communication with IC001.

Troubleshooting Hints

1) If the screen is blank with no output check:

- Video signals with proper cutoff levels are provided to the CRT cathodes.
- Supply voltages are at the appropriate levels and locations starting at CN304.
- Heater voltage is correct and present at the heater cathode.
- Diode shorts at the cathodes.
- There is I^2C communication to IC001.

2) If the screen is lighted with no video check:

- Control, blanking and clamp signals to IC001, IC002.
- +5V, +12V, and +80V to these circuits.
- For shorted diodes on the IC002 outputs.

3) If colors are wrong or missing and white balance cannot be adjusted check:

- Each individual color signal path comparing DC offset and peak to peak signal levels to each other to determine if there is any single amplifier at fault.
- For shorted diodes on the IC002 outputs.
- G1 level at the cathode (-33V)

2. On Screen Display Functions

On Screen Display(OSD)

IC003 is the On Screen Display character and graphic generator. It provides RGB and Fast Blanking data to IC001 for mixing with the main video channels when required. Outputs voltages are two dimensional, either 0V or 5V. IC003 is controlled by the Microprocessor via the I2C bus. The sync timings necessary are H Retrace and V Retrace.

Troubleshooting Hints

1) No OSD is displayed, check:

- RGB and Fast Blanking inputs to IC001. If there are no signals then IC003 may be at fault.
- That +5V is supplied to IC003
- V FLB and H FLB signals are at pins 10 and 5 of IC003 respectfully.
- That there is I2C communication to IC003.

3. G2

Troubleshooting Hints

1) If picture is black, check:

- G2 level at the cathode using HV probe (typically 350V ~ 750V).
- Input to G2 amp, Pin 5 of IC005.
- Heater voltage at the cathode.
- +12V, +5V, and G2 voltage coming from D board.

4. Display Data Channel (DDC) Circuit

DDC2B allows the display to inform the host computer of it's identity and capability. IC906, which has memory and I^2C bus serial communication capability, is a device for DDC2B. Pin 5 and 6 of IC906 are prepared for SDA (I^2C data) and SCL (I^2C clock). EDID (Extended Display Identification Data) consists of 128 bytes of data containing the display's identity and

capability. This is written into the memory of IC906. The DDC compatible host computer reads the EDID using pins 12 and 15 of the VGA connector (see the table below regarding the contents of EDID and the VGA connector).

DDC2Bi allows the display to communicate more detailed data to the graphic host computer. IC901 is a micro-controller, which contains DDC2Bi and I^2C bus serial communication capability. Pins 34 and 35 of IC901 are prepared for SDA (I^2C data) and SCL (I^2C clock). These are connected to pins 12 and 15 of the VGA connector shared with IC906

Troubleshooting Hints

1. If an error occurs in the DDC communication, the DDC compatible host computer indicates "unknown monitor", or the available resolution will be minimized. Watch the pulses on the SDA and SCL to check to see if the DDC communication succeeds. Knowledge of I^2C bus serial communication is required to distinguish the error.

DDC Data Format and VGA Connector Allocations

Basic EDID consists of 128 bytes		15 pin VGA type connector			
Number	**Description**	**Pin No.**	**Assignment**	**Pin No.**	**Assignment**
8 Bytes	Header	1	RED Video	11	Option
10 Bytes	Vender/Product Identification	2	GREEN Video	12	Data (SDA)
2 Bytes	EDID Version/Revision	3	BLUE Video	13	H SYNC
5 Bytes	Basic Display Parameters/Features	4	Option	14	V SYNC
10 Bytes	Color Characteristics	5	Return	15	Clock (SCL)
3 Bytes	Established Timings	6	Red Return		
16 Bytes	Standard Timings	7	Green Return		
72 Bytes	Detailed Timing Description	8	Blue Return		
1 Byte	Extension Flag	9	Option +5V		
1 Byte	Checksum	10	Sync Return		

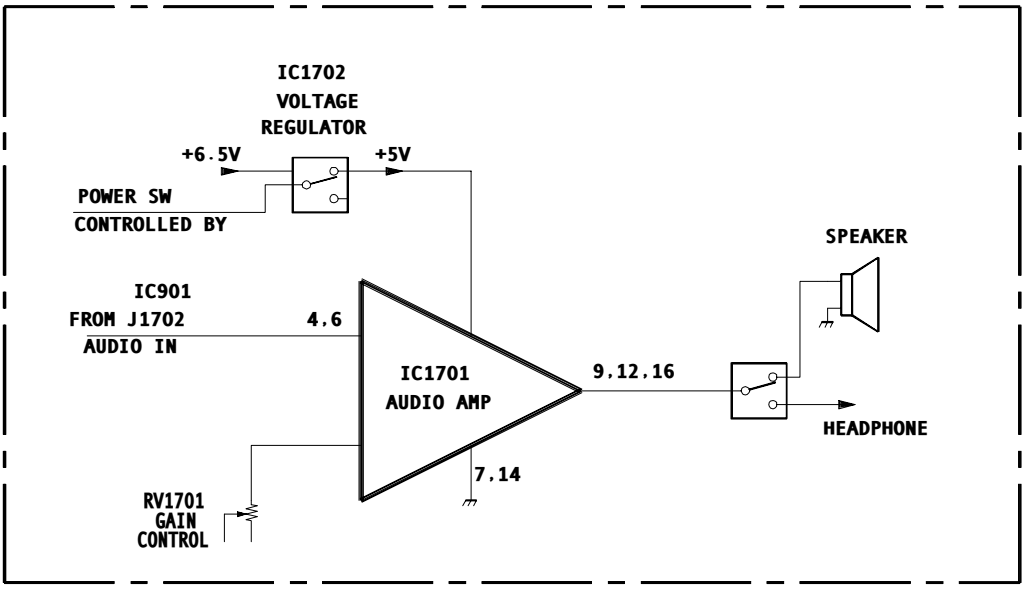
U BOARD: AUDIO CIRCUIT

IC1701 is the Audio Amplifier IC. It receives audio left and right signals through the audio input jack (J1702) and outputs the amplified signals to the mono speaker and the stereo headphone jack (J1701). The amplitude level is controlled by RV1701.

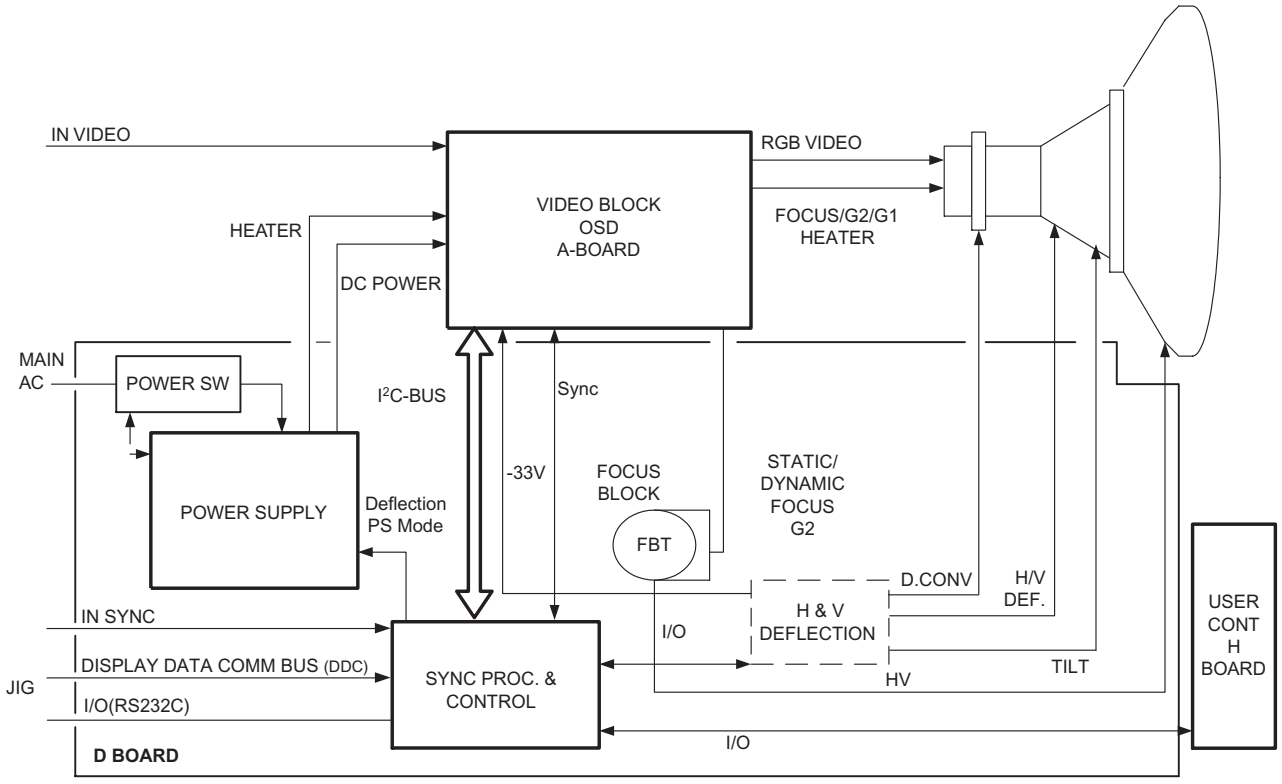
J1701 has a mechanical switch on it. If the headphone jack is connected, the signal line of the speaker is disconnected (headphone = on; speaker = off). If the headphone jack is not connected, the output signal is provided to the speaker (headphone = off; speaker = on).

IC1702 is a voltage regulator with a switch. It receives +6.5V from the stand-by power supply circuit and outputs +5V to IV1701. When the monitor is in active off mode, IC1702 stops supplying VCC to IC1701 (audio function deactivated, controlled by Micro, IC901).

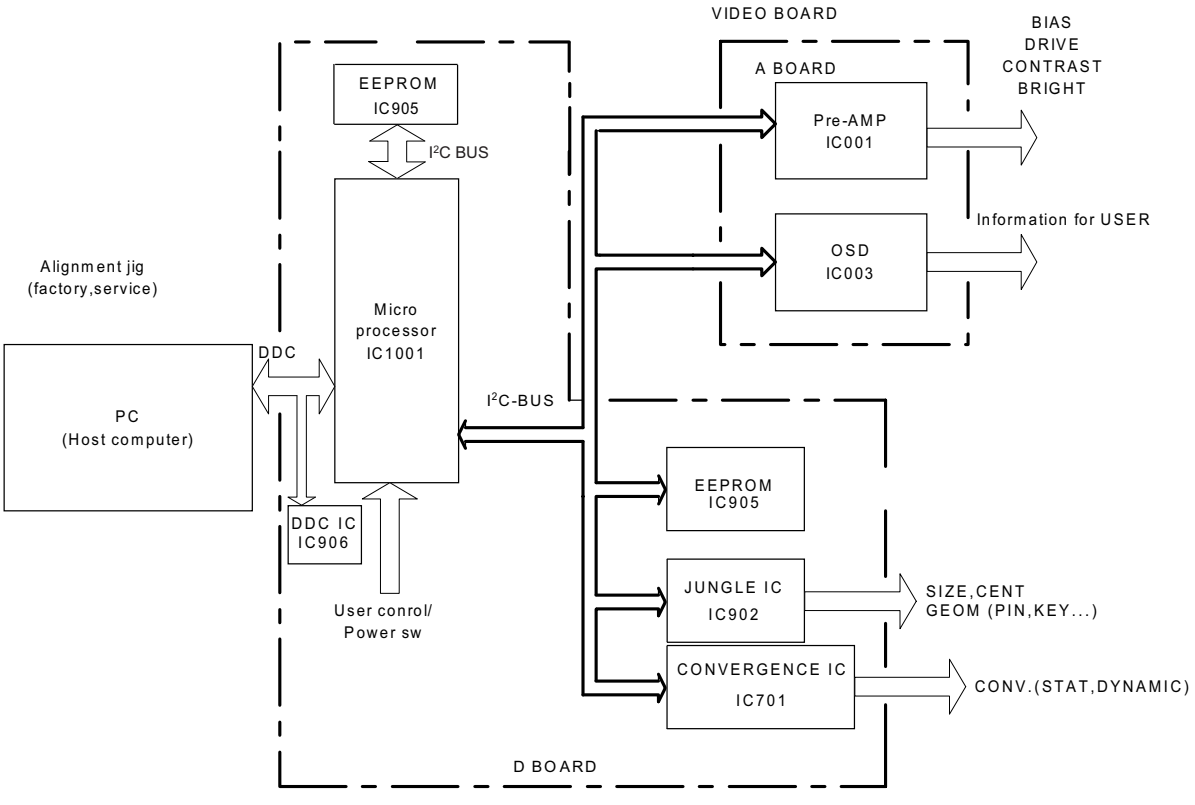
Audio Circuit Block Diagram



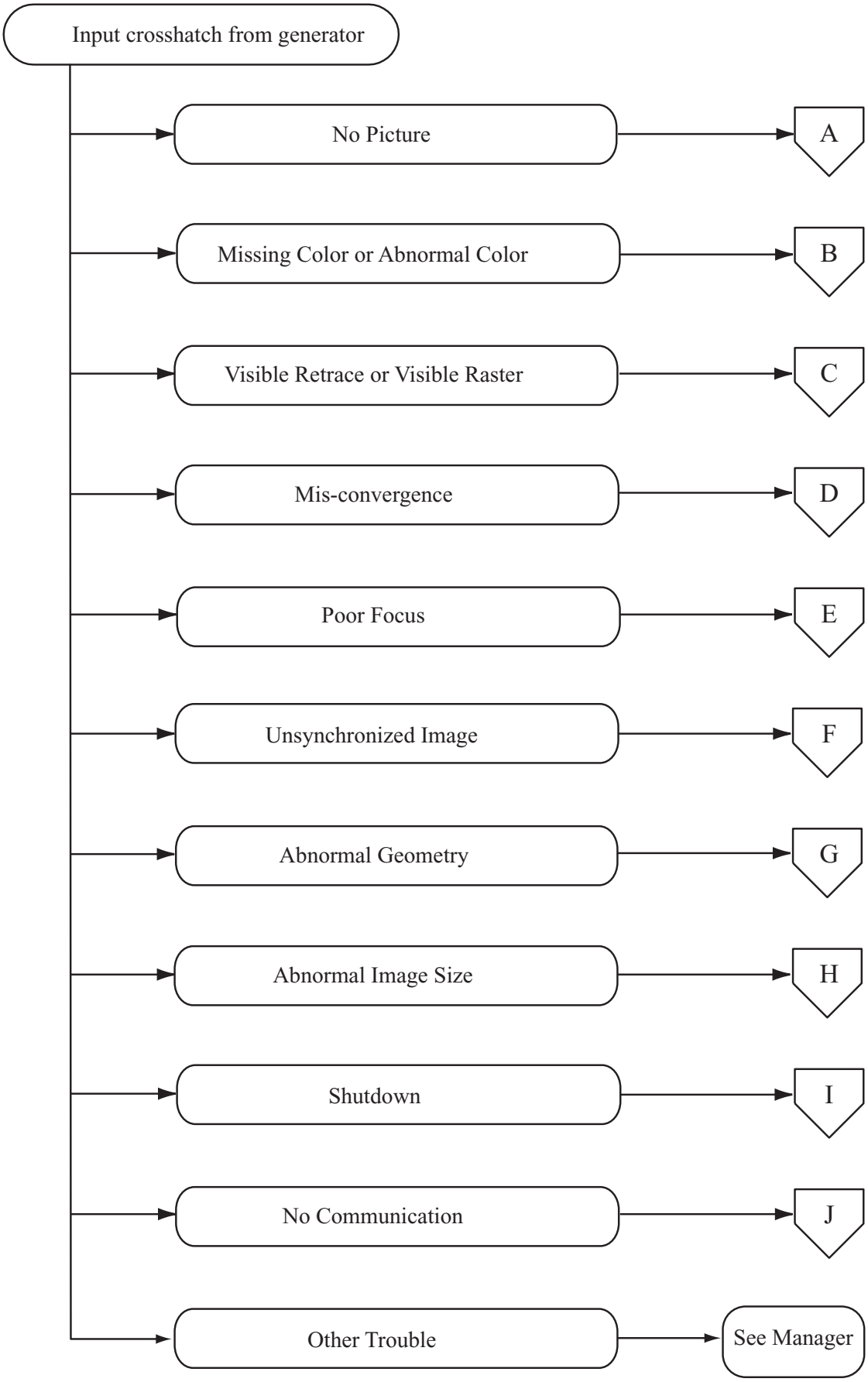
System Block Diagram



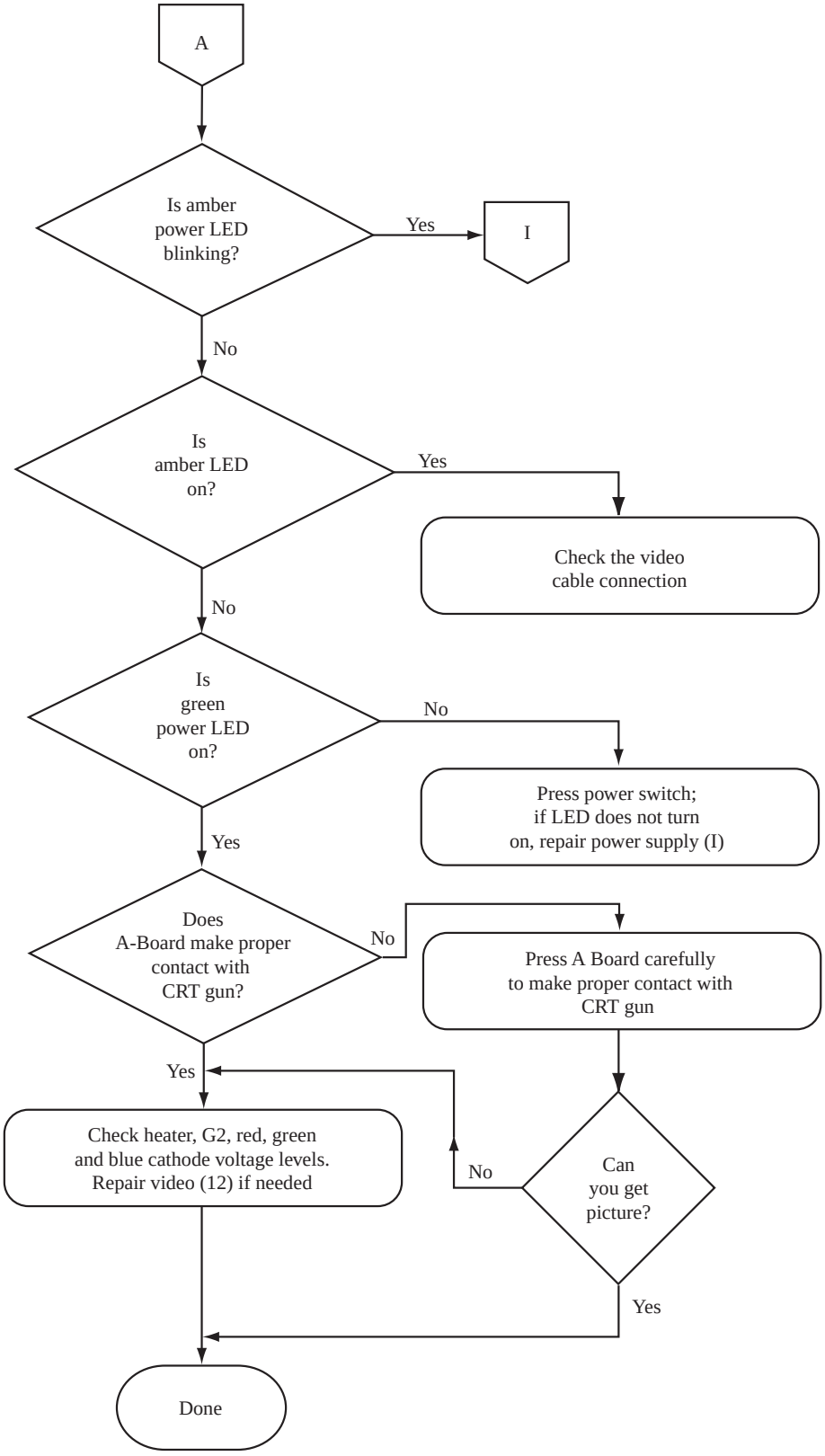
Digital Control Communication Diagram



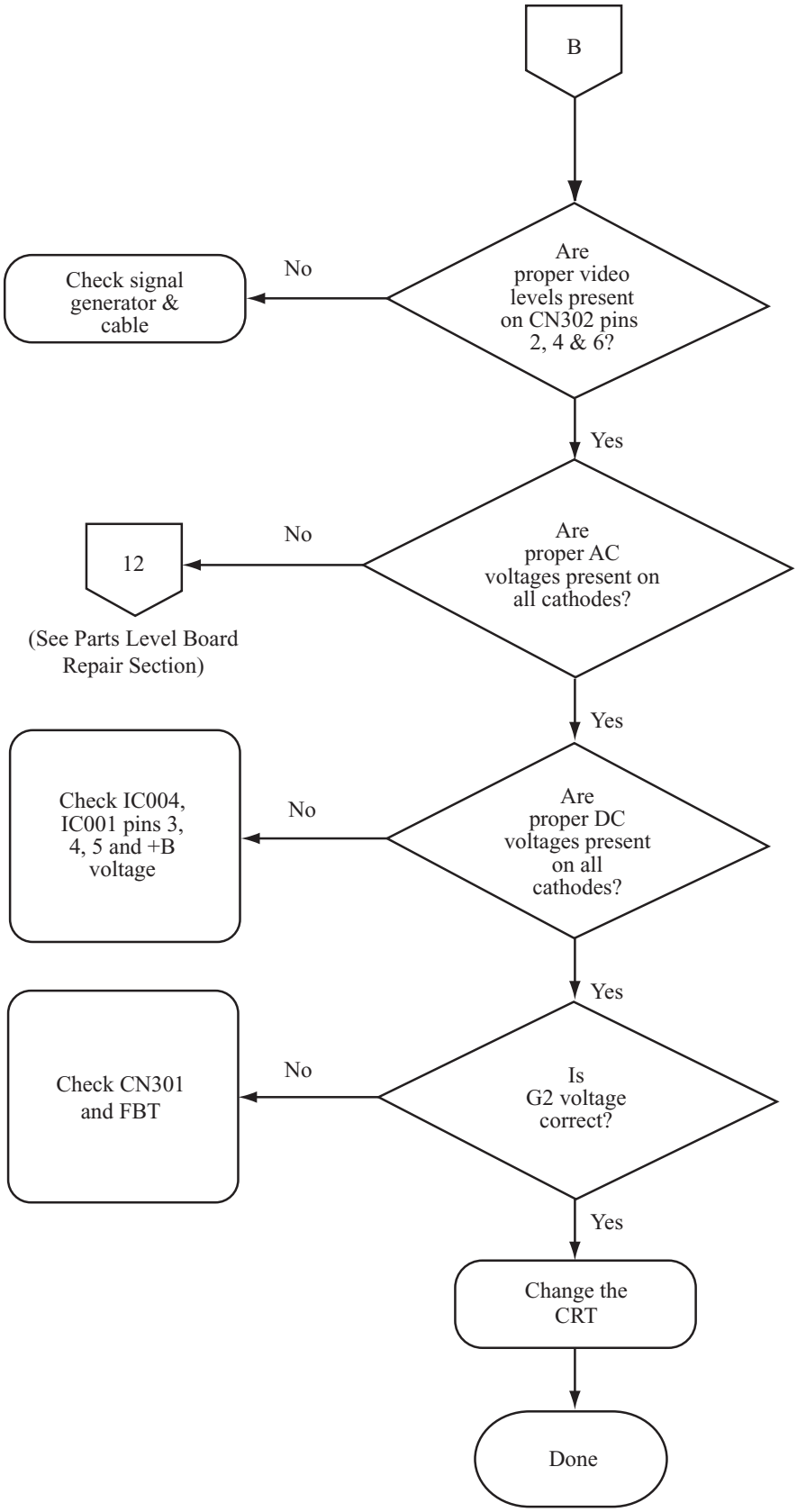
GENERAL TROUBLESHOOTING



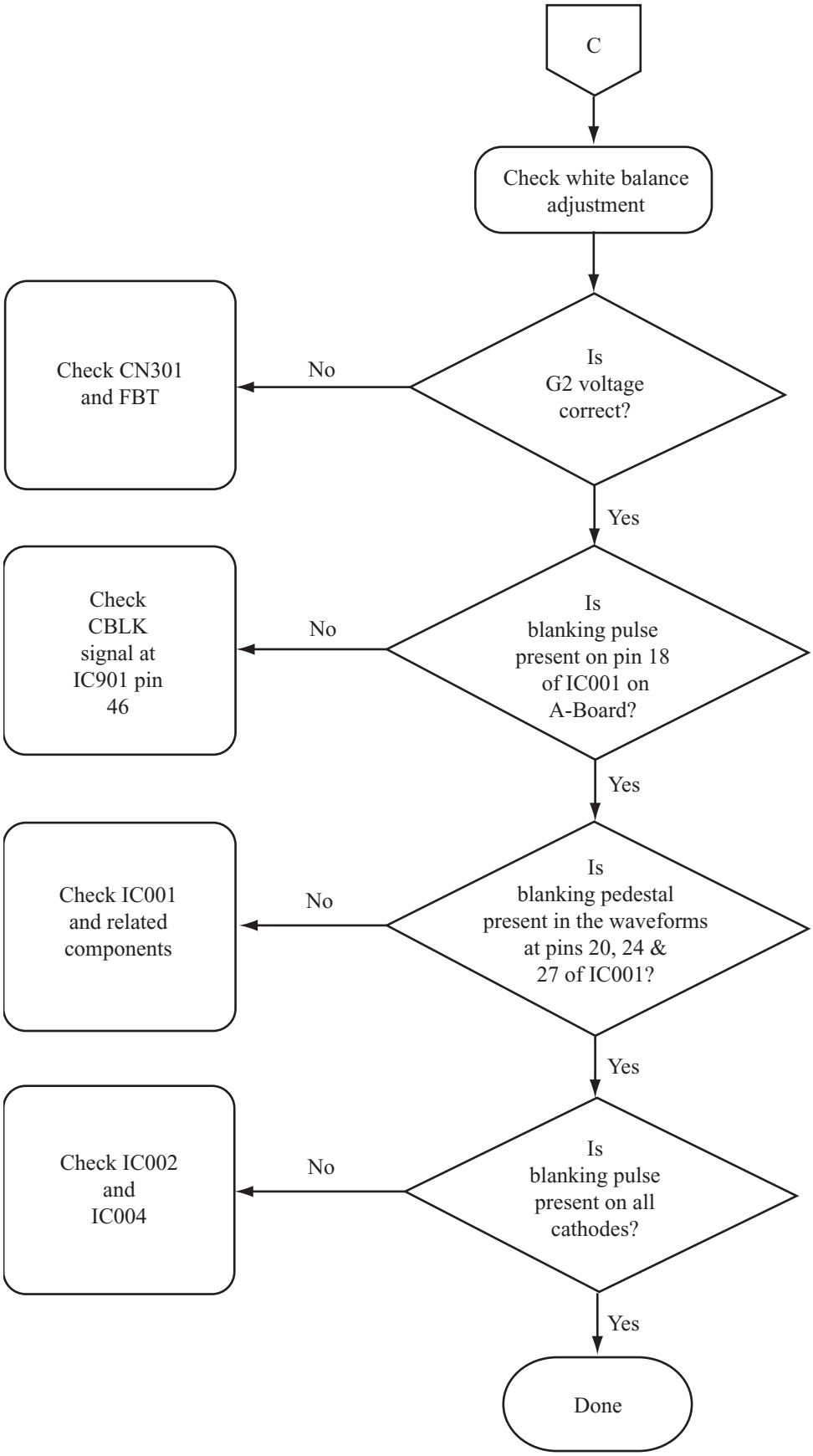
NO PICTURE


A
Is amber power LED blinking?
Yes
I
No
Is amber LED on?
Yes
Check the video cable connection
No
Is green power LED on?
No
Press power switch; if LED does not turn on, repair power supply (I)
Yes
Does A-Board make proper contact with CRT gun?
No
Press A Board carefully to make proper contact with CRT gun
Yes
Check heater, G2, red, green and blue cathode voltage levels. Repair video (12) if needed
No
Can you get picture?
Yes
Done

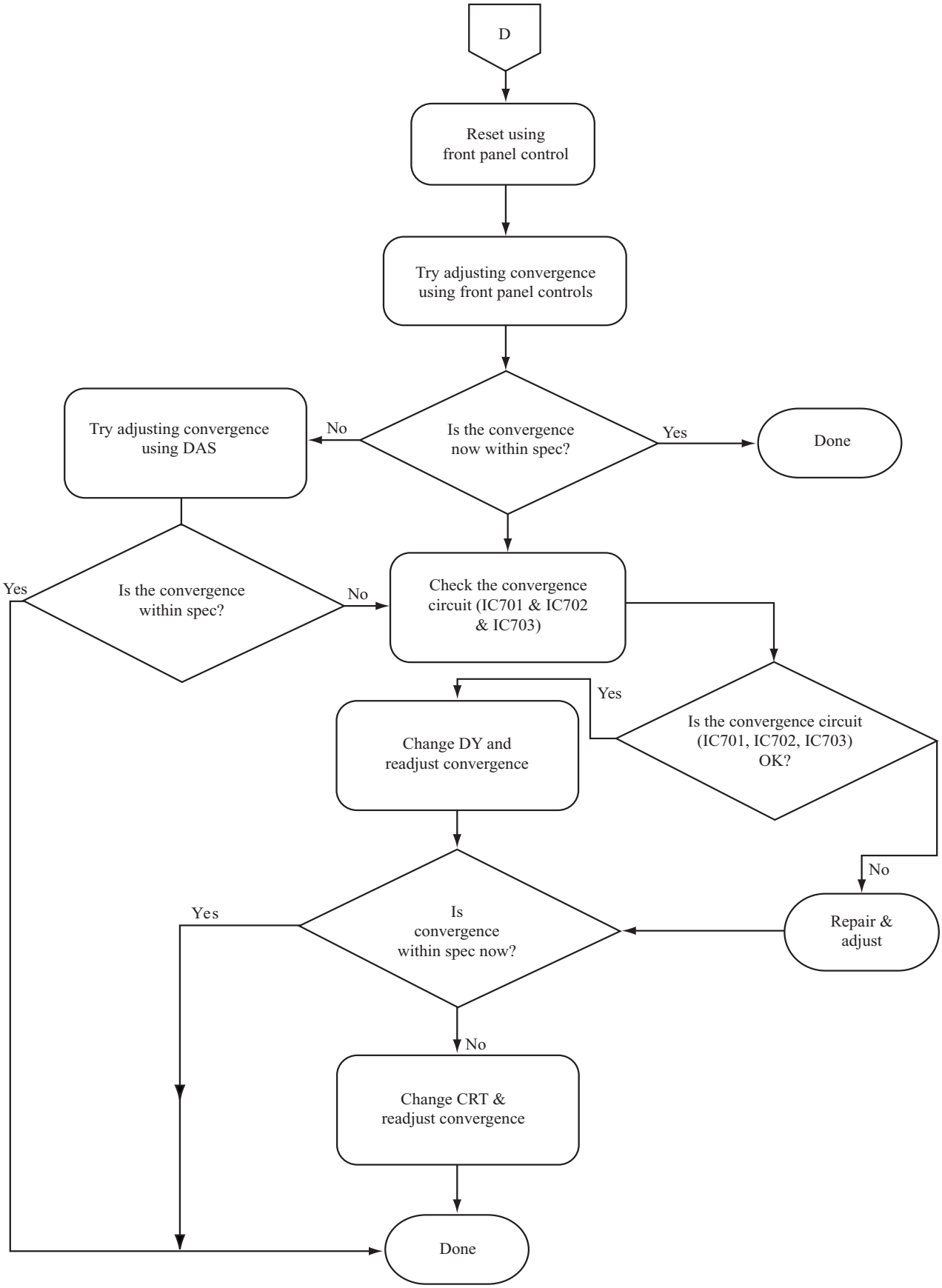
MISSING COLOR



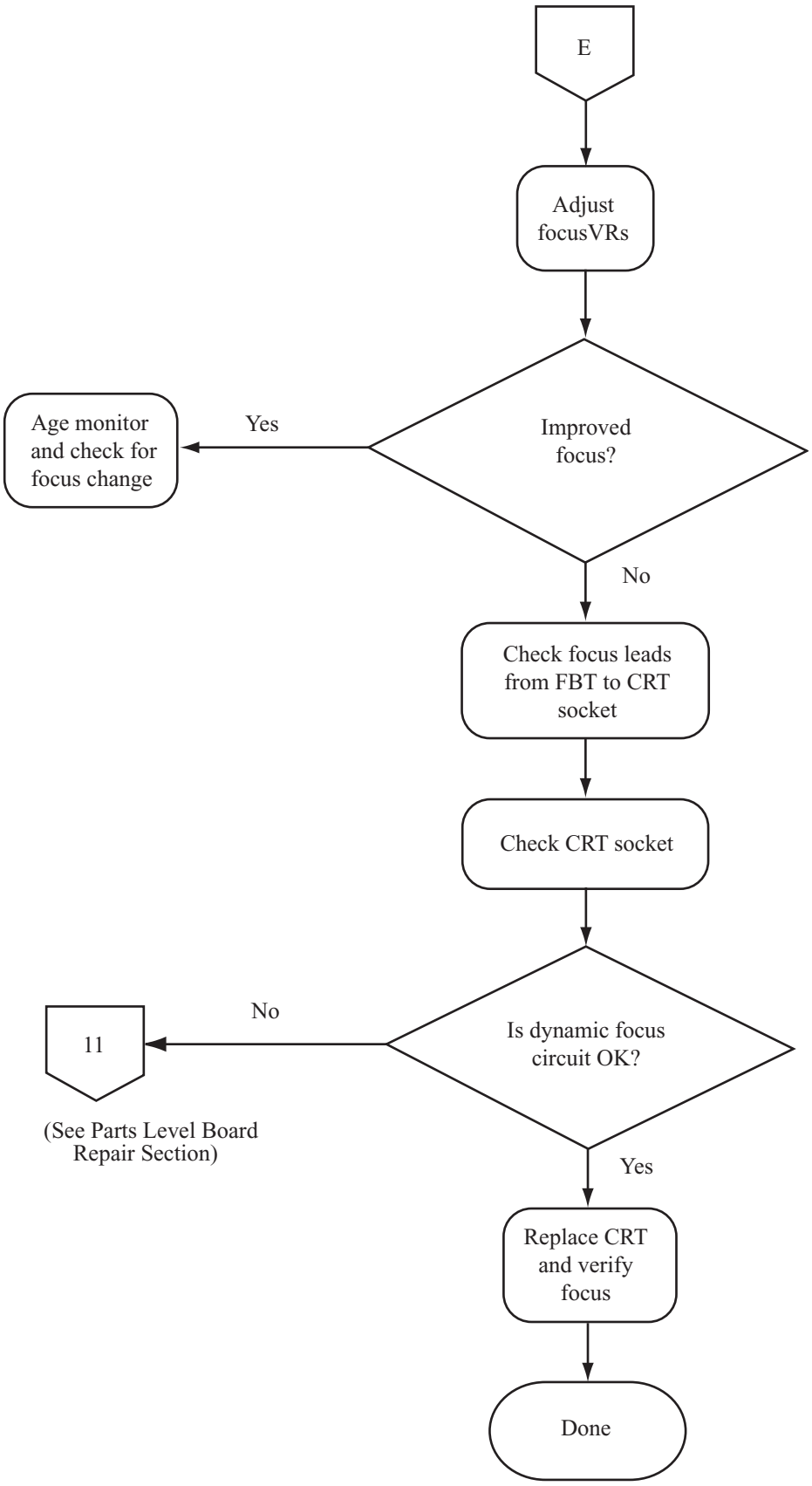
VISIBLE RETRACE



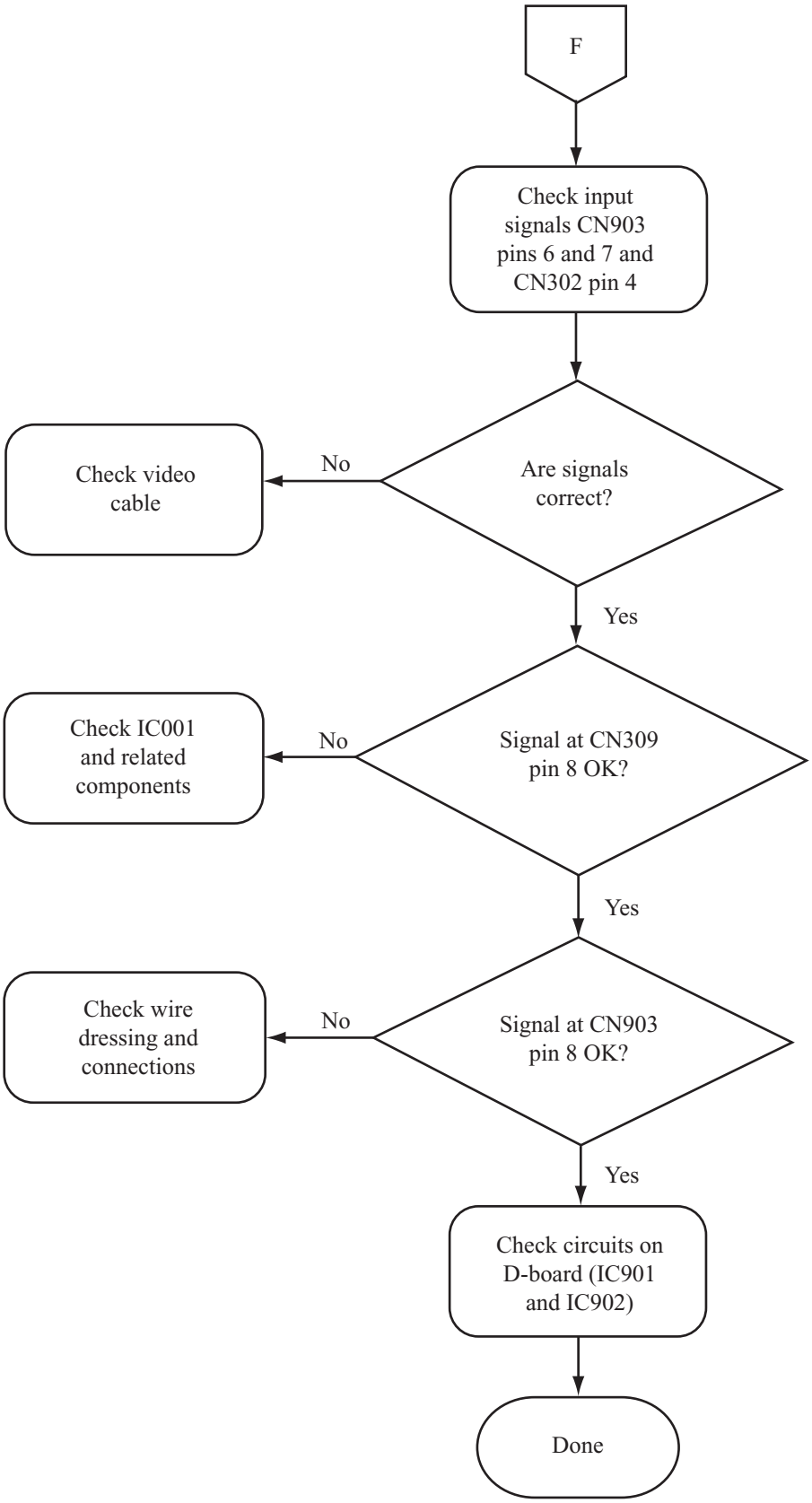
MISCONVERGENCE



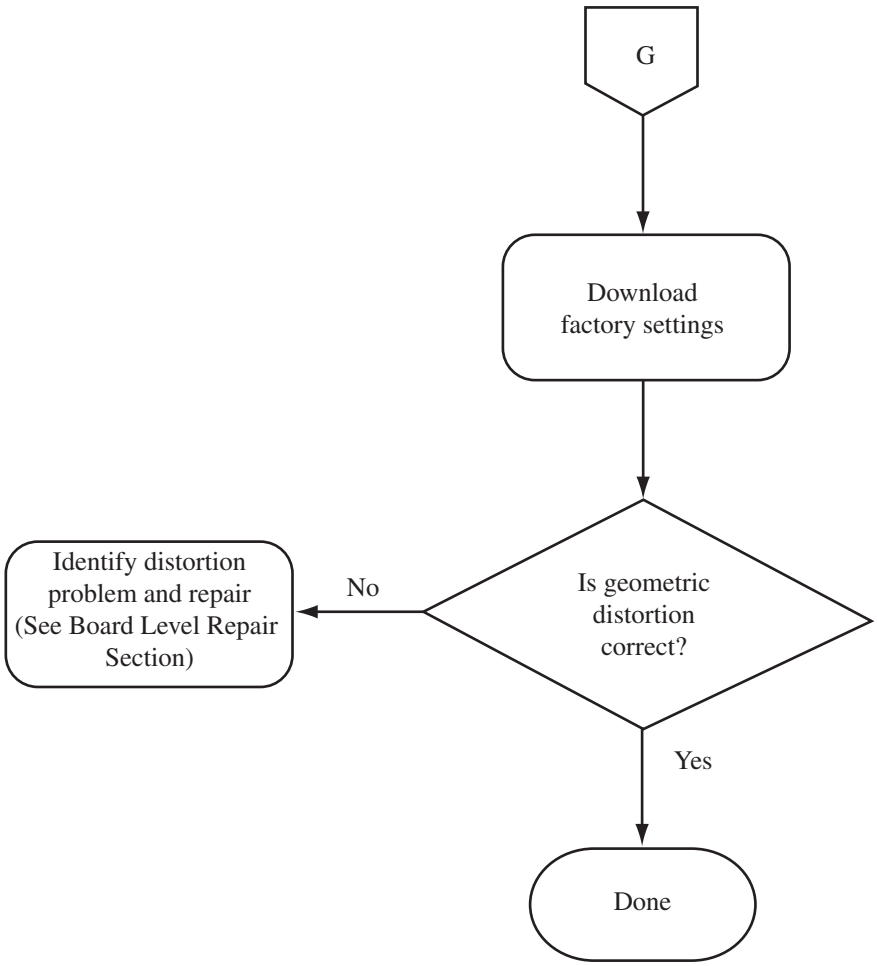
POOR FOCUS


E
Adjust focusVRs
Improved focus?
Yes
Age monitor and check for focus change
No
Check focus leads from FBT to CRT socket
Check CRT socket
Is dynamic focus circuit OK?
No
11
(See Parts Level Board Repair Section)
Yes
Replace CRT and verify focus
Done

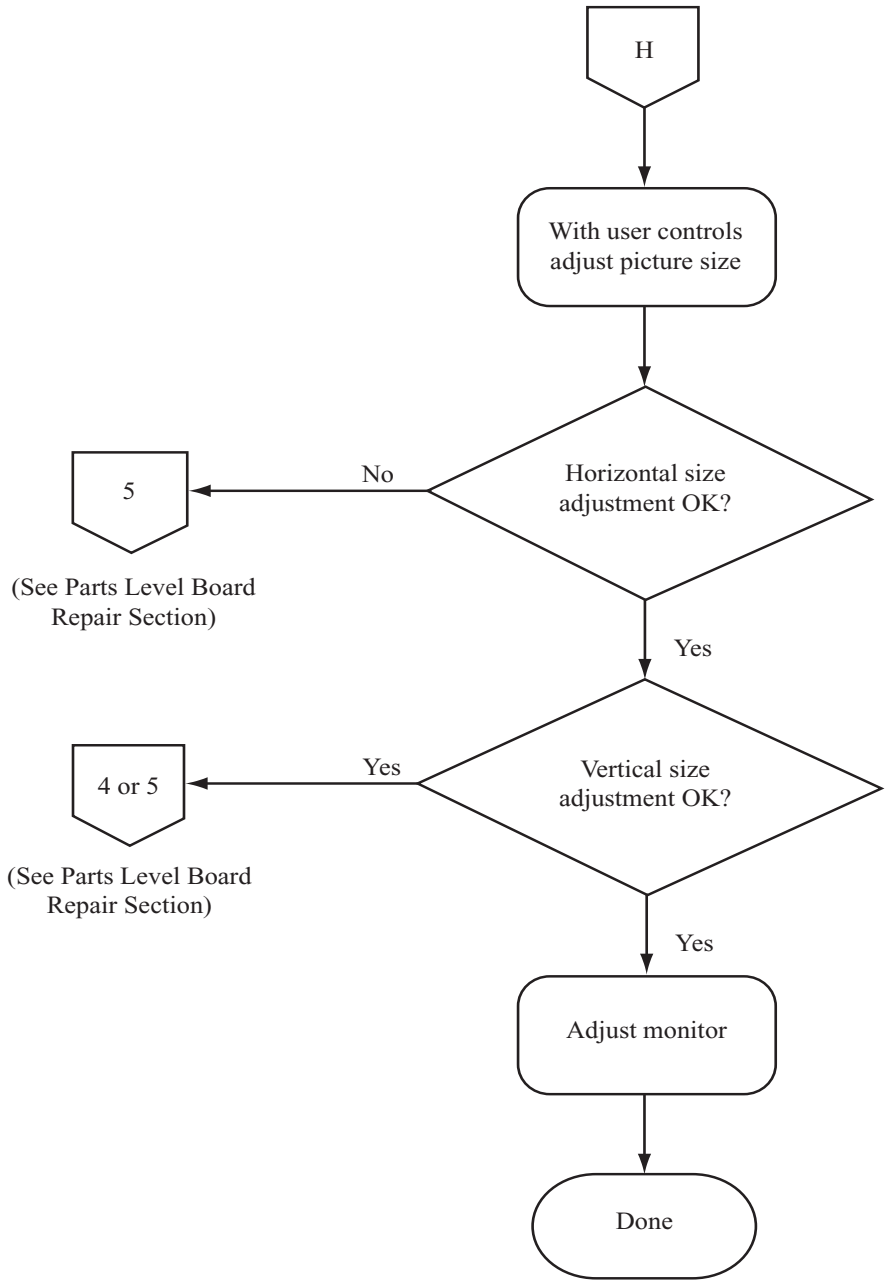
UNSYNCHRONIZED IMAGE



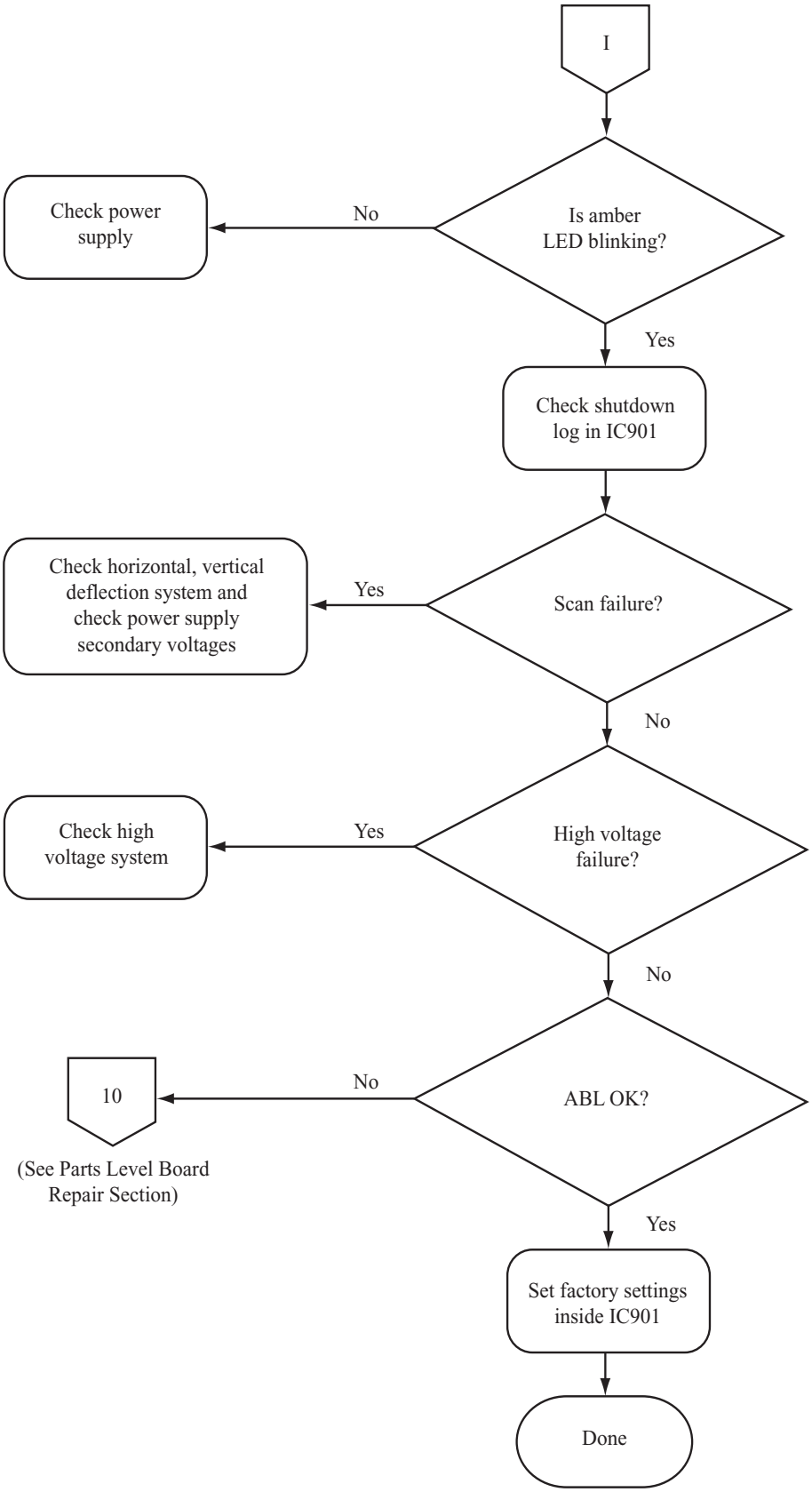
ABNORMAL GEOMETRIC DISTORTION



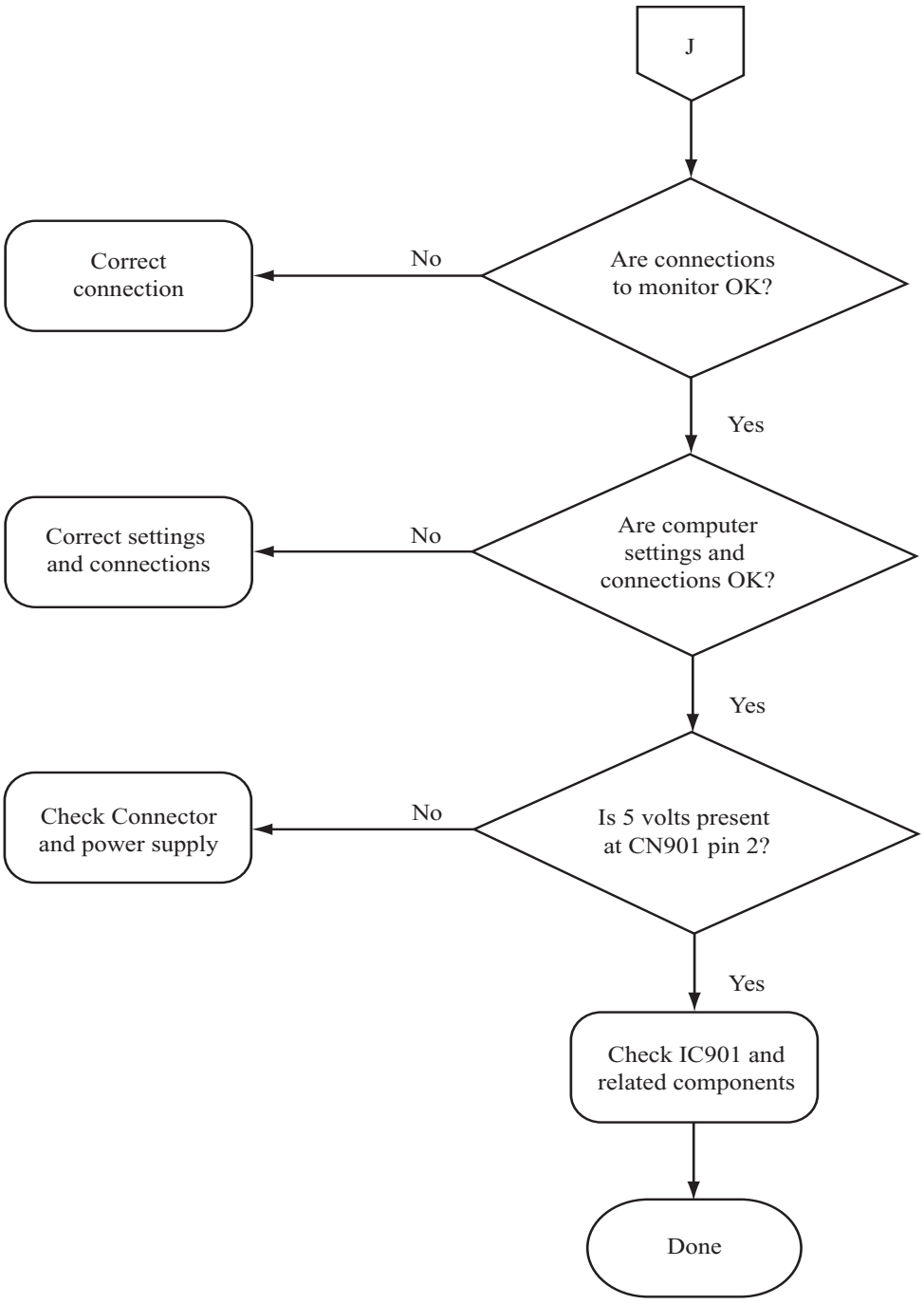
ABNORMAL IMAGE SIZE



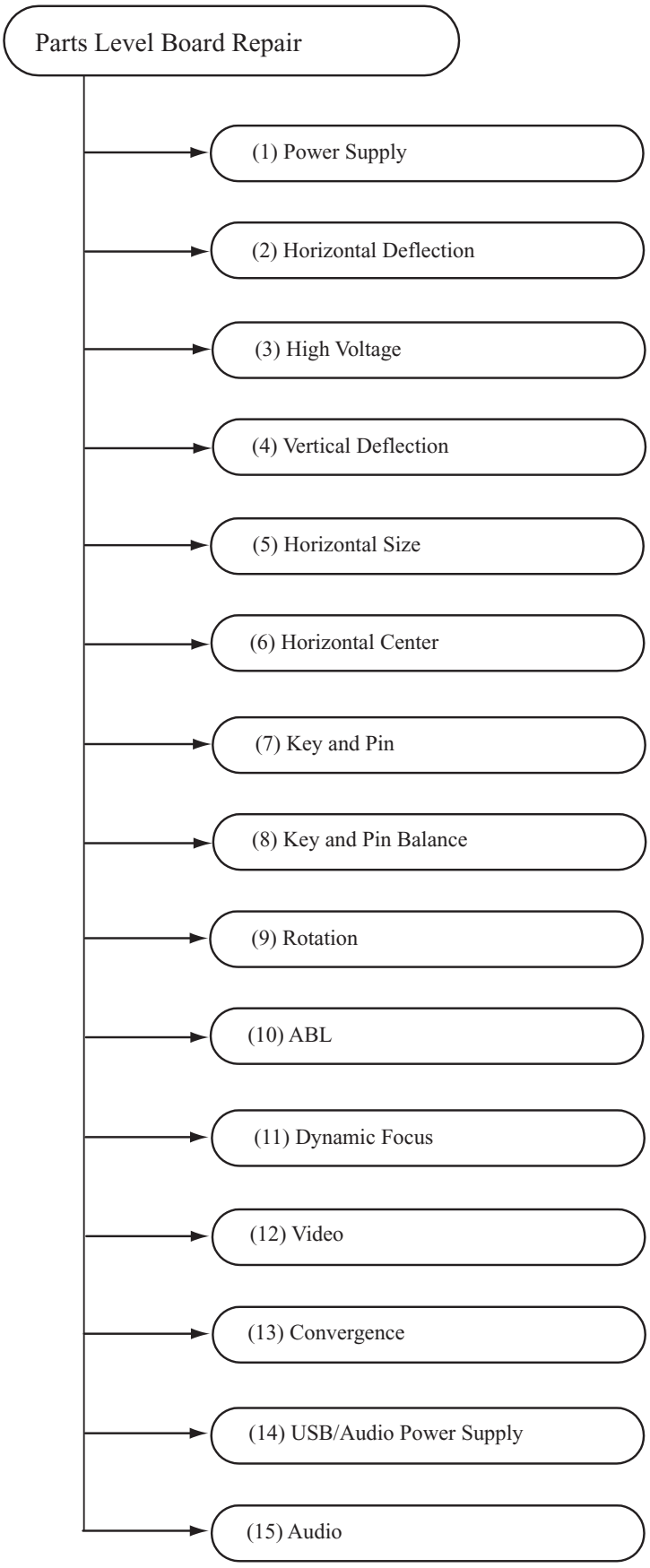
SHUT DOWN


I
Is amber LED blinking?
No
Check power supply
Yes
Check shutdown log in IC901
Scan failure?
Yes
Check horizontal, vertical deflection system and check power supply secondary voltages
No
High voltage failure?
Yes
Check high voltage system
No
ABL OK?
No
10
(See Parts Level Board Repair Section)
Yes
Set factory settings inside IC901
Done

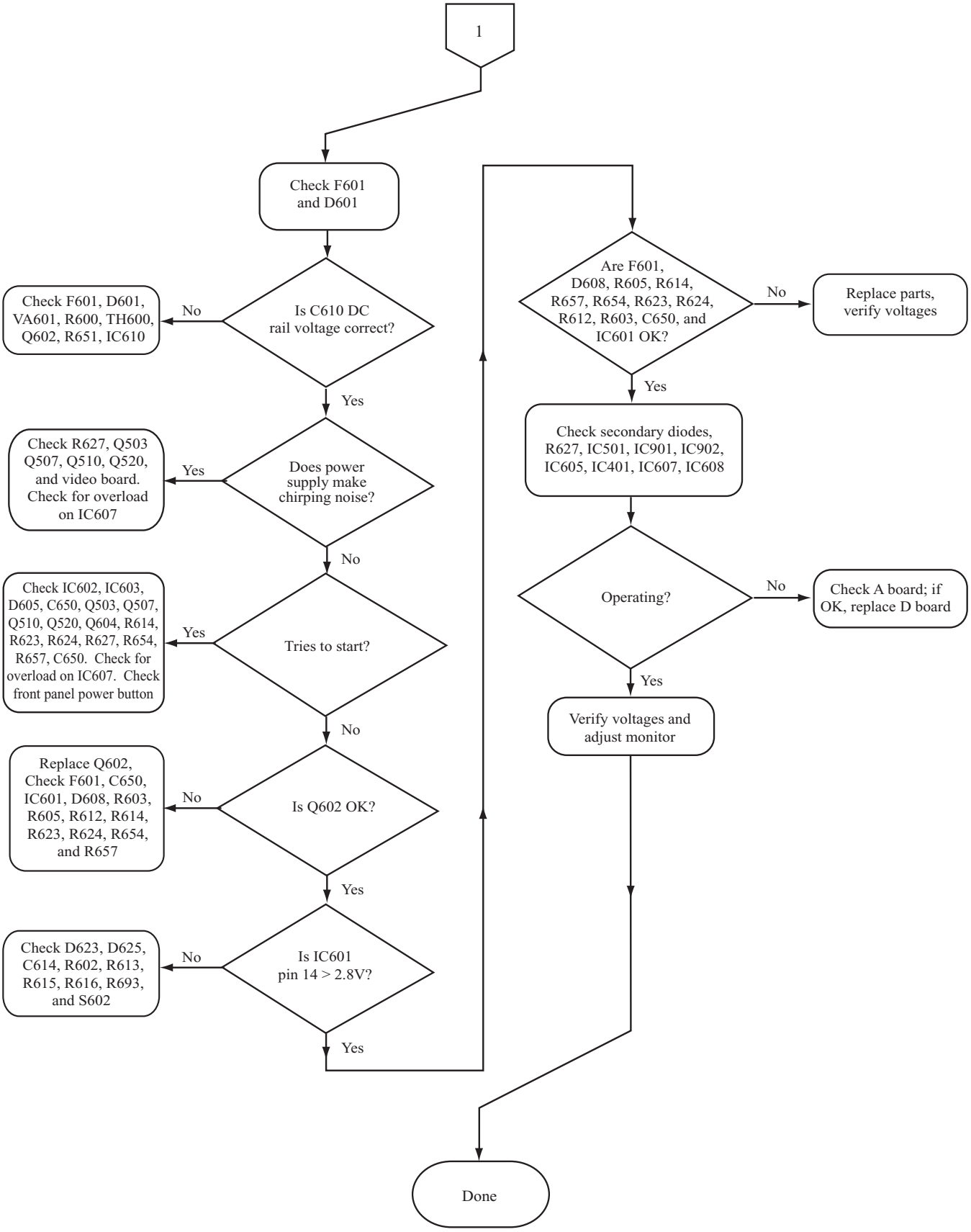
NO COMMUNICATION



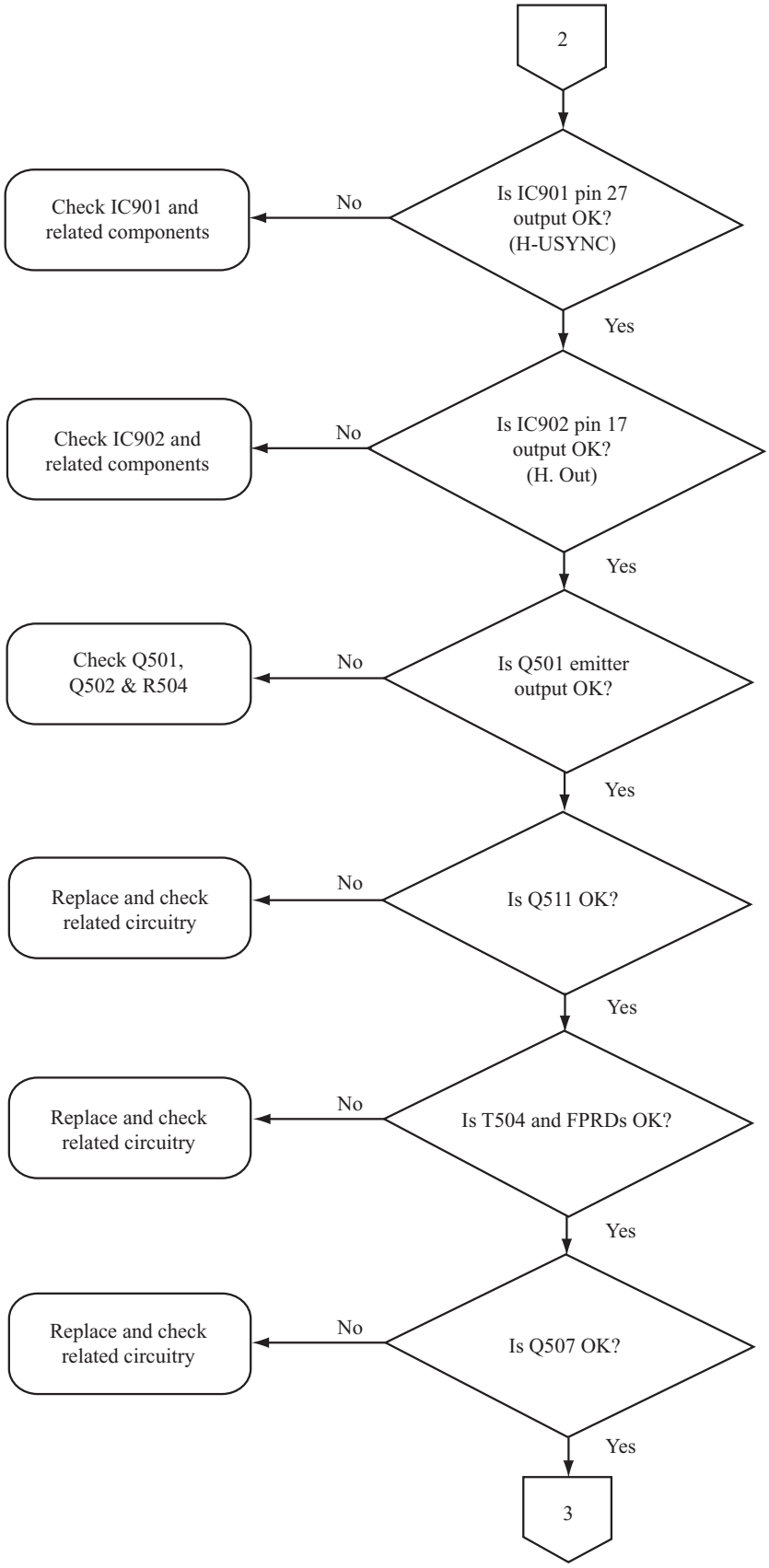
PARTS LEVEL BOARD REPAIR



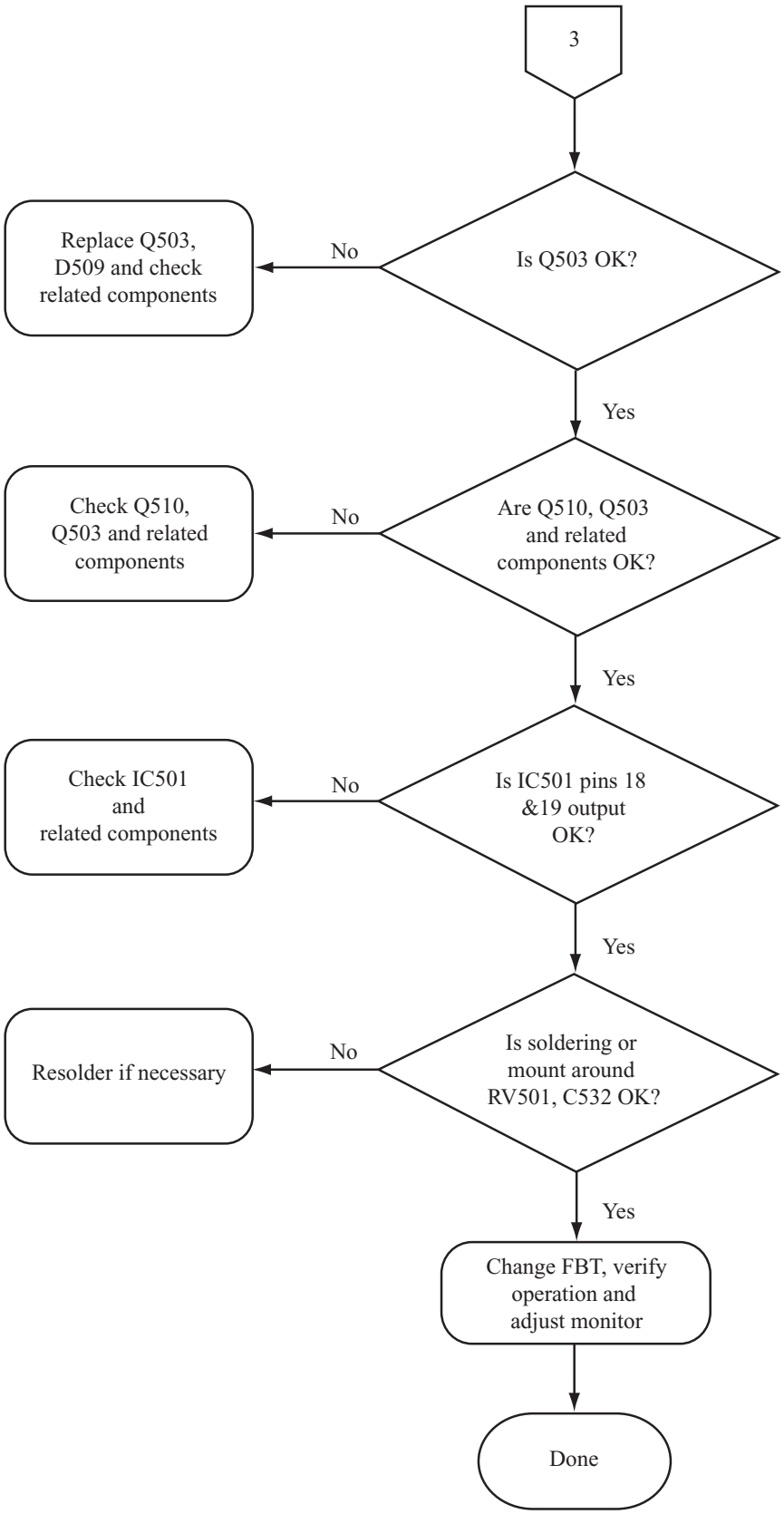
POWER SUPPLY


1
Check F601 and D601
Is C610 DC rail voltage correct?
No
Check F601, D601, VA601, R600, TH600, Q602, R651, IC610
Yes
Does power supply make chirping noise?
Yes
Check R627, Q503 Q507, Q510, Q520, and video board. Check for overload on IC607
No
Tries to start?
Yes
Check IC602, IC603, D605, C650, Q503, Q507, Q510, Q520, Q604, R614, R623, R624, R627, R654, R657, C650. Check for overload on IC607. Check front panel power button
No
Is Q602 OK?
No
Replace Q602, Check F601, C650, IC601, D608, R603, R605, R612, R614, R623, R624, R654, and R657
Yes
Is IC601 pin 14 > 2.8V?
No
Check D623, D625, C614, R602, R613, R615, R616, R693, and S602
Yes
Are F601, D608, R605, R614, R657, R654, R623, R624, R612, R603, C650, and IC601 OK?
No
Replace parts, verify voltages
Yes
Check secondary diodes, R627, IC501, IC901, IC902, IC605, IC401, IC607, IC608
Operating?
No
Check A board; if OK, replace D board
Yes
Verify voltages and adjust monitor
Done

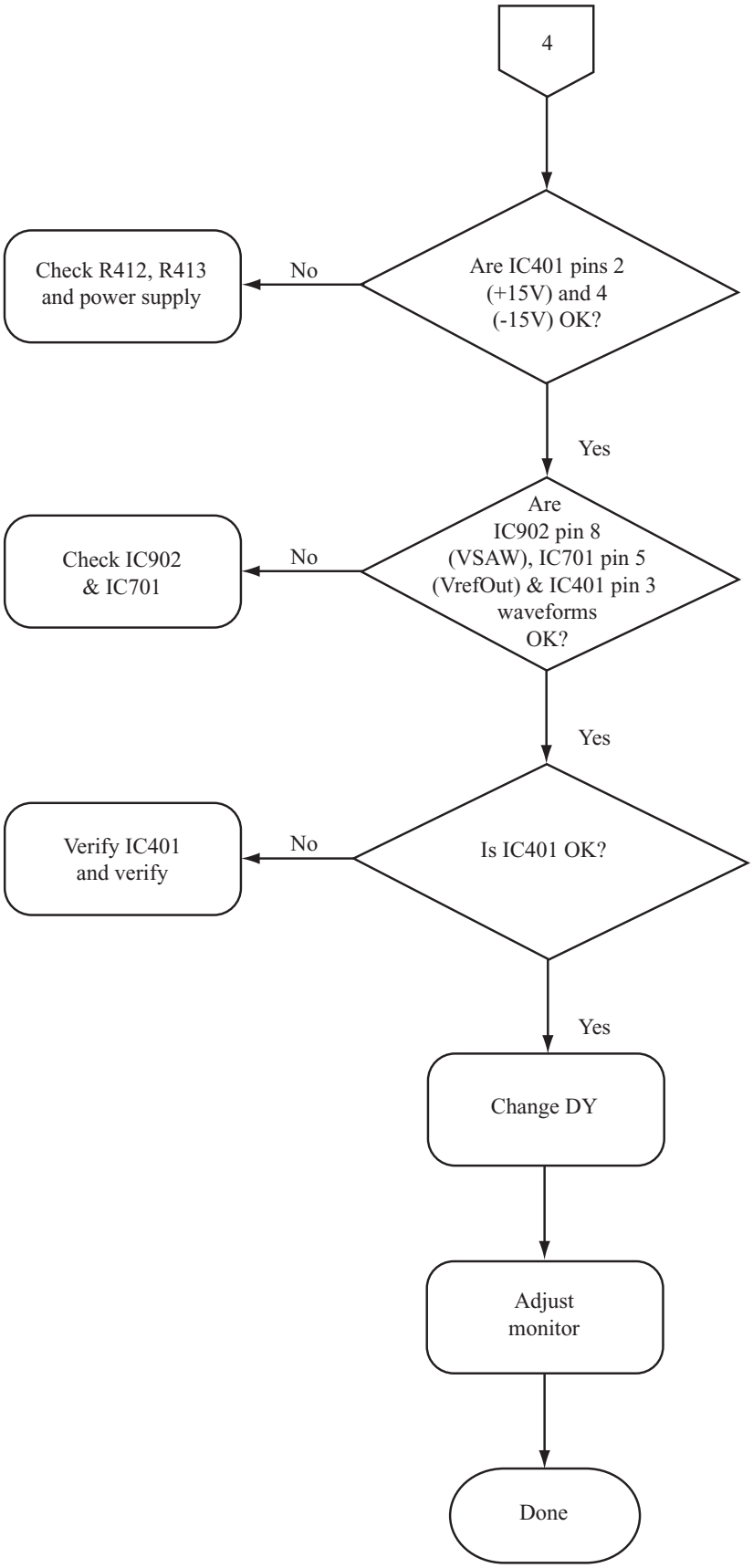
HORIZONTAL DEFLECTION



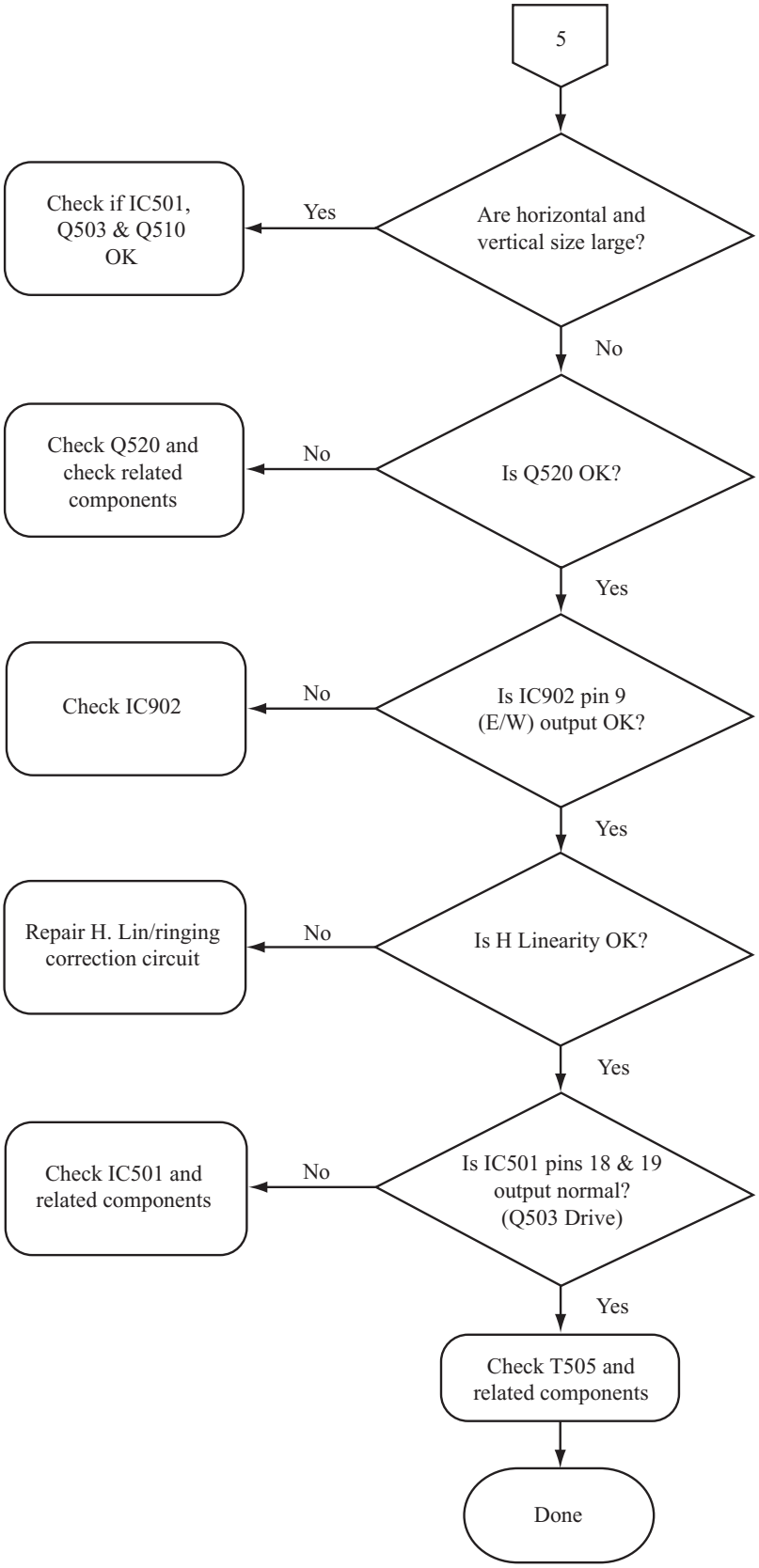
HIGH VOLTAGE



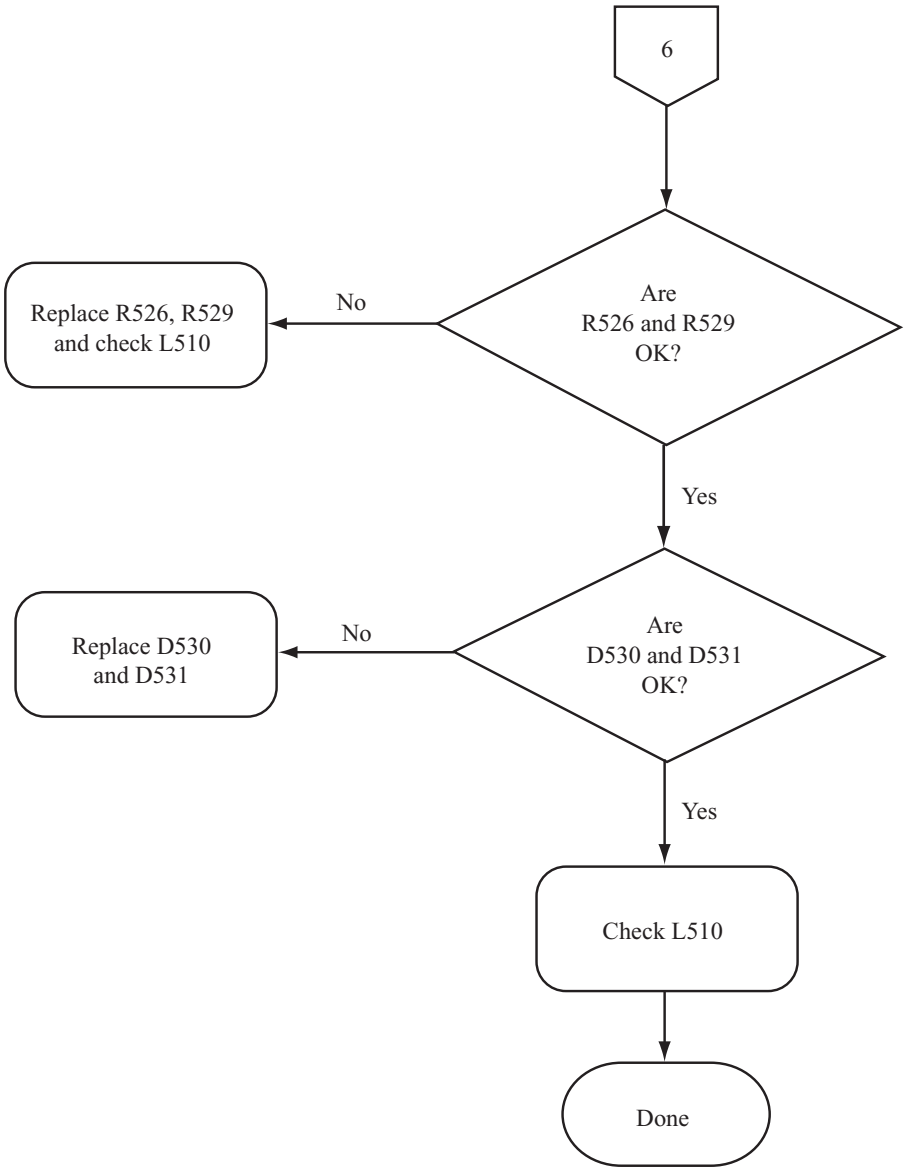
VERTICAL DEFLECTION



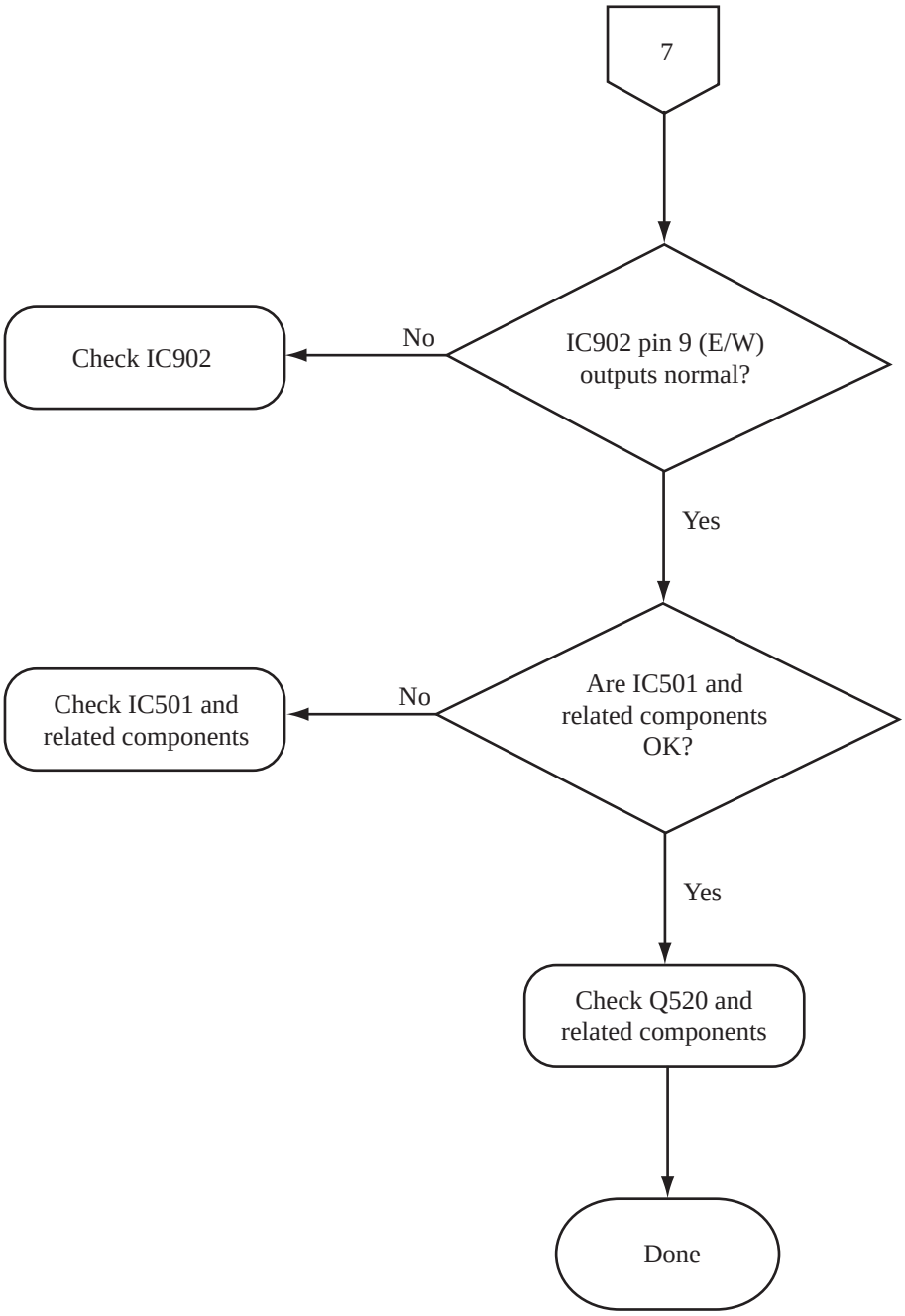
HORIZONTAL SIZE



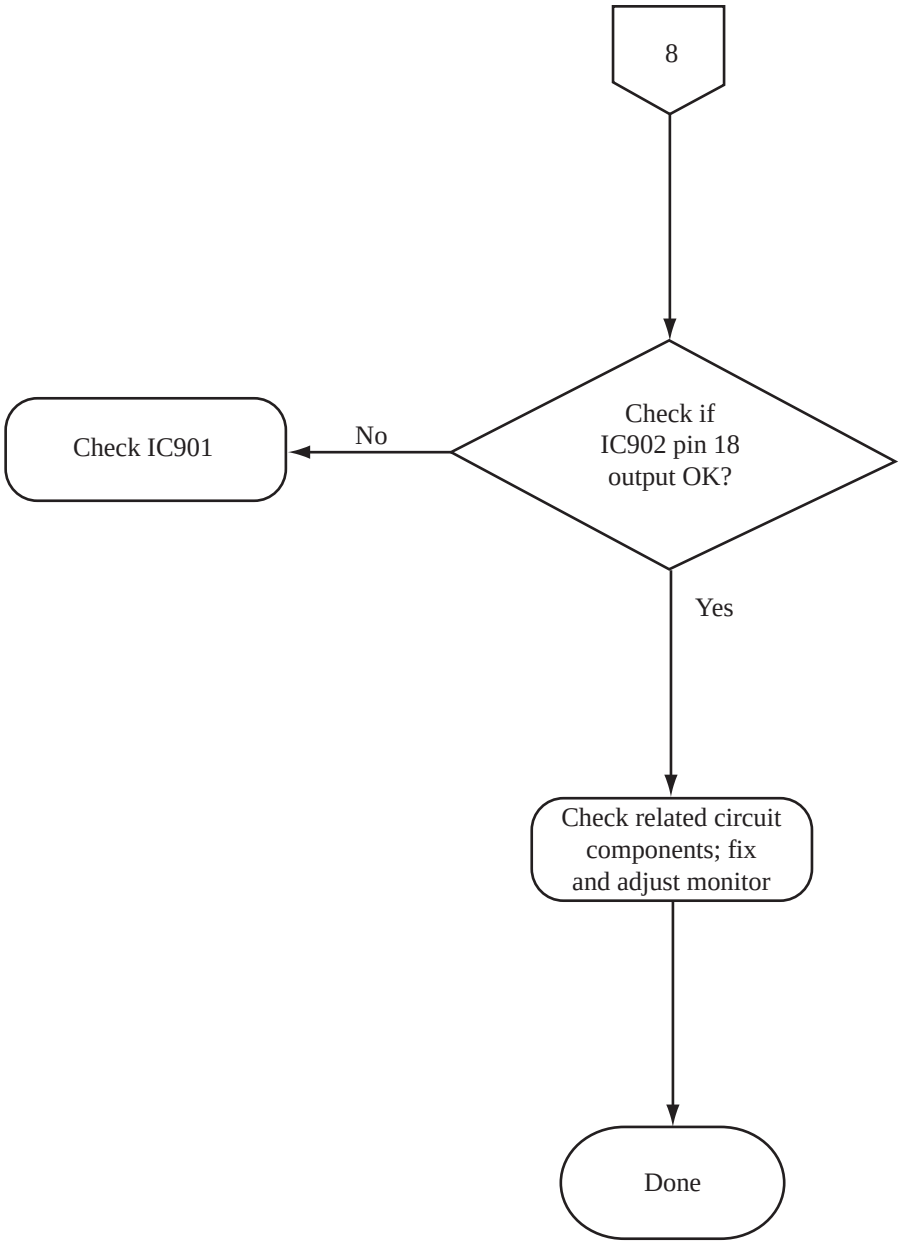
HORIZONTAL CENTER



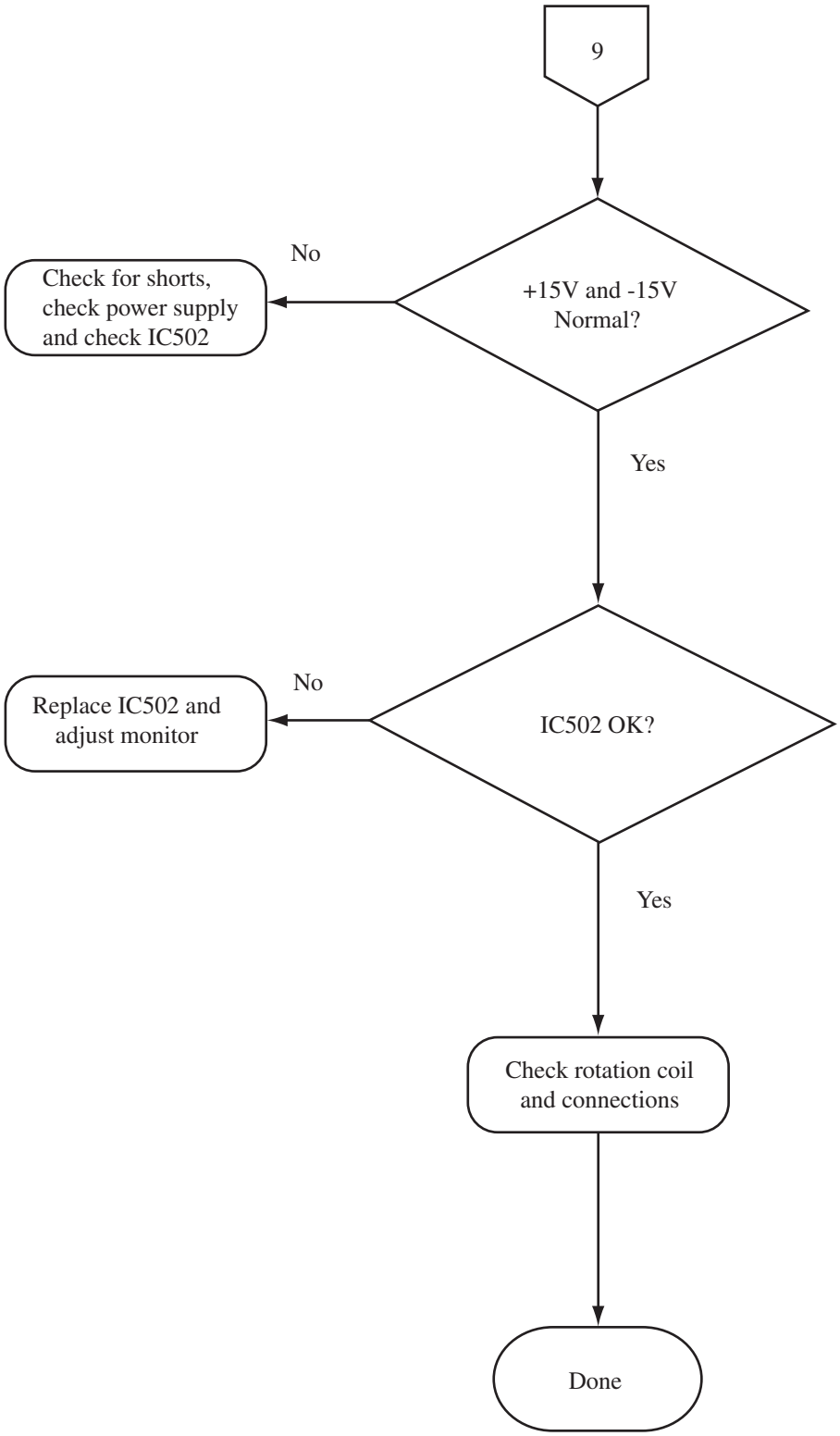
KEY AND PIN


7
IC902 pin 9 (E/W) outputs normal?
No
Check IC902
Yes
Are IC501 and related components OK?
No
Check IC501 and related components
Yes
Check Q520 and related components
Done

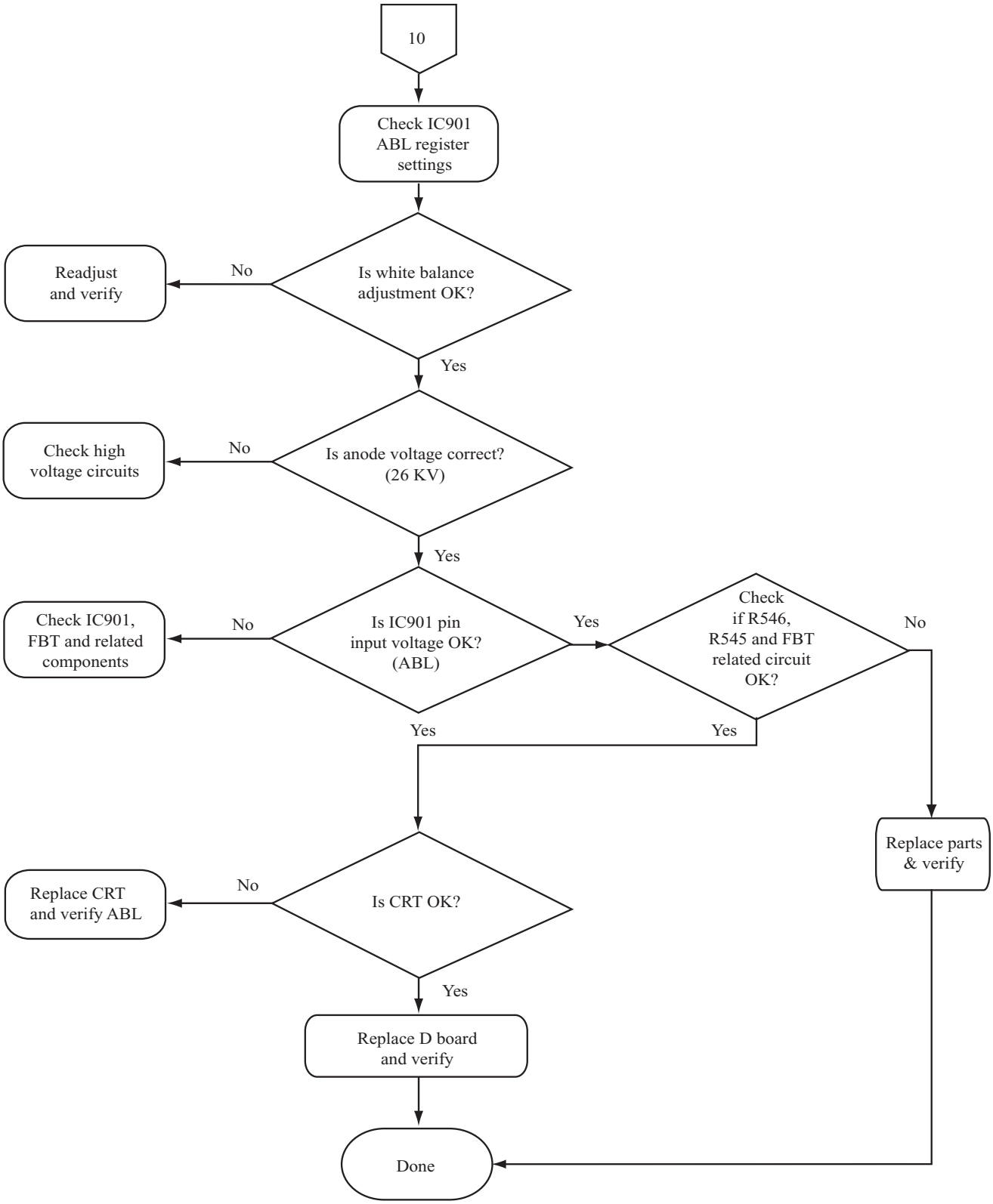
KEY AND PIN BALANCE



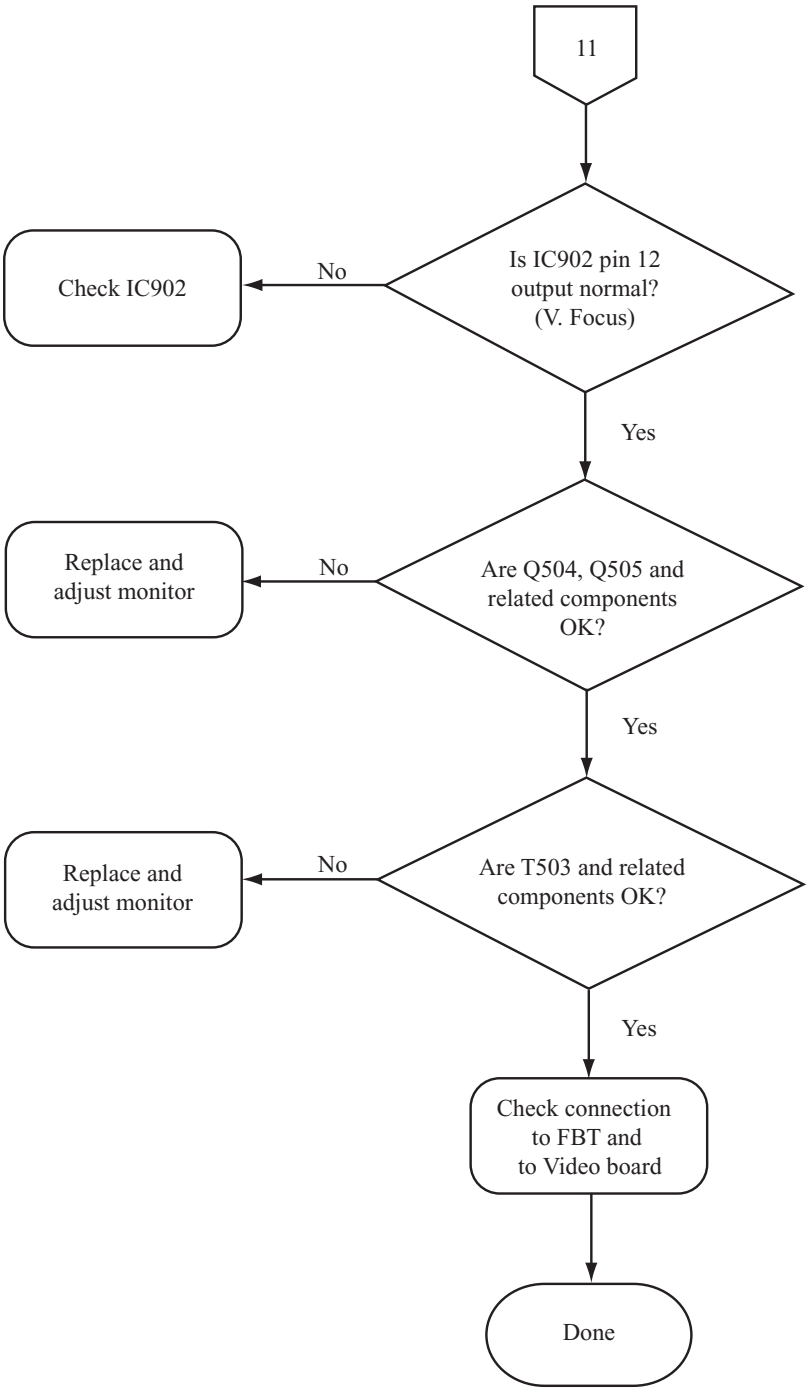
ROTATION


9
+15V and -15V Normal?
No
Check for shorts, check power supply and check IC502
Yes
IC502 OK?
No
Replace IC502 and adjust monitor
Yes
Check rotation coil and connections
Done

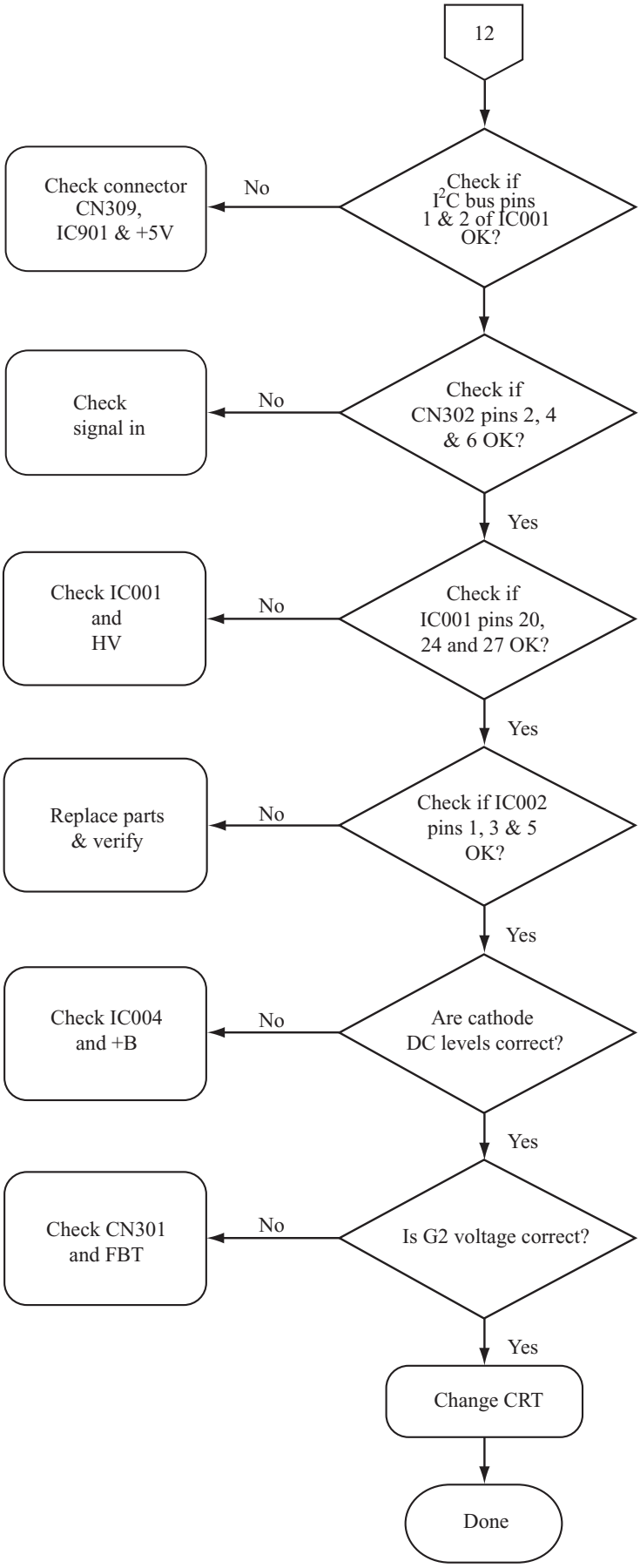
ABL FAILURE


10
Check IC901 ABL register settings
Is white balance adjustment OK?
No
Readjust and verify
Yes
Is anode voltage correct? (26 KV)
No
Check high voltage circuits
Yes
Is IC901 pin input voltage OK? (ABL)
No
Check IC901, FBT and related components
Yes
Check if R546, R545 and FBT related circuit OK?
No
Replace parts & verify
Yes
Yes
Is CRT OK?
No
Replace CRT and verify ABL
Yes
Replace D board and verify
Done

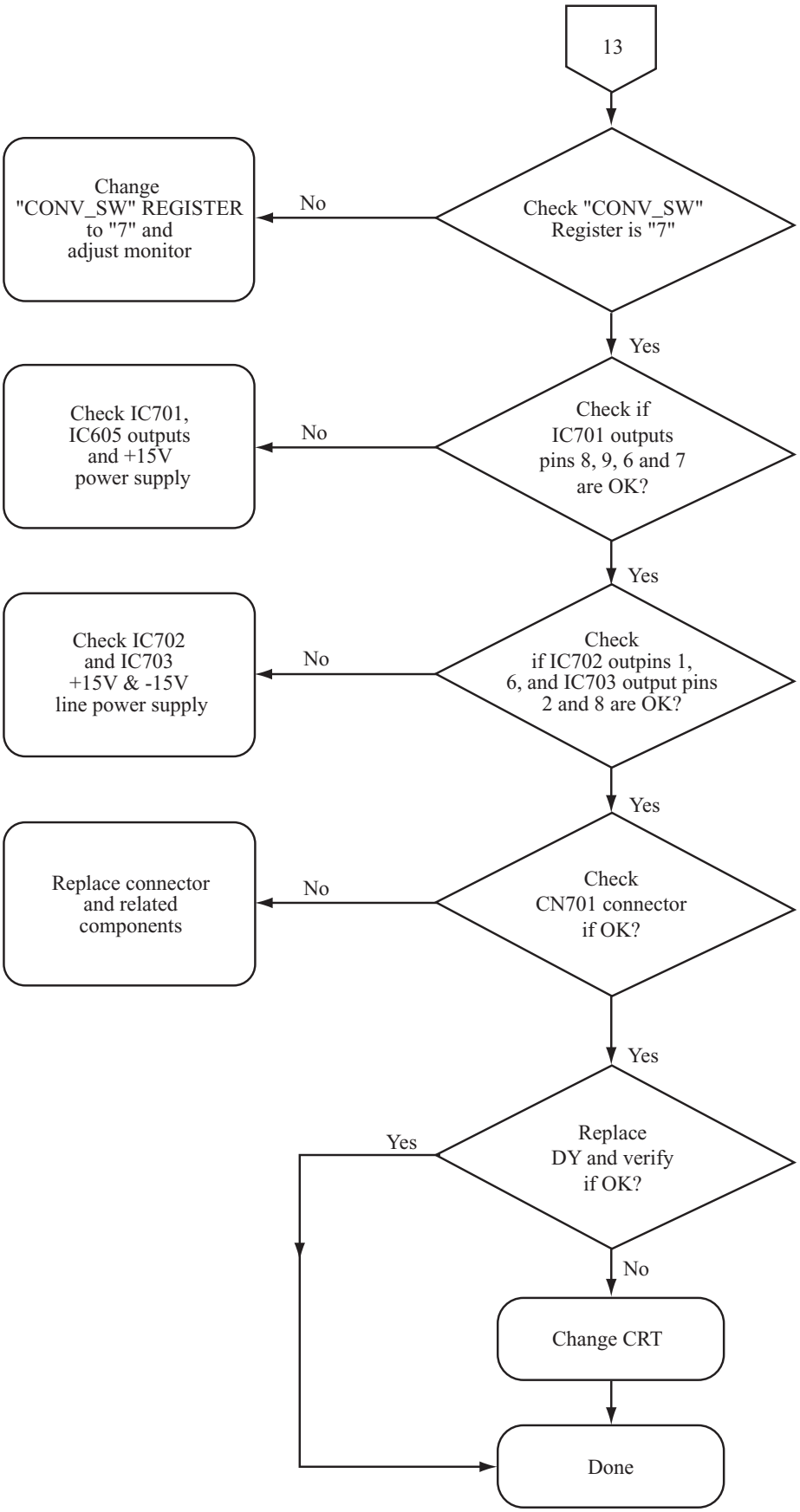
DYNAMIC FOCUS



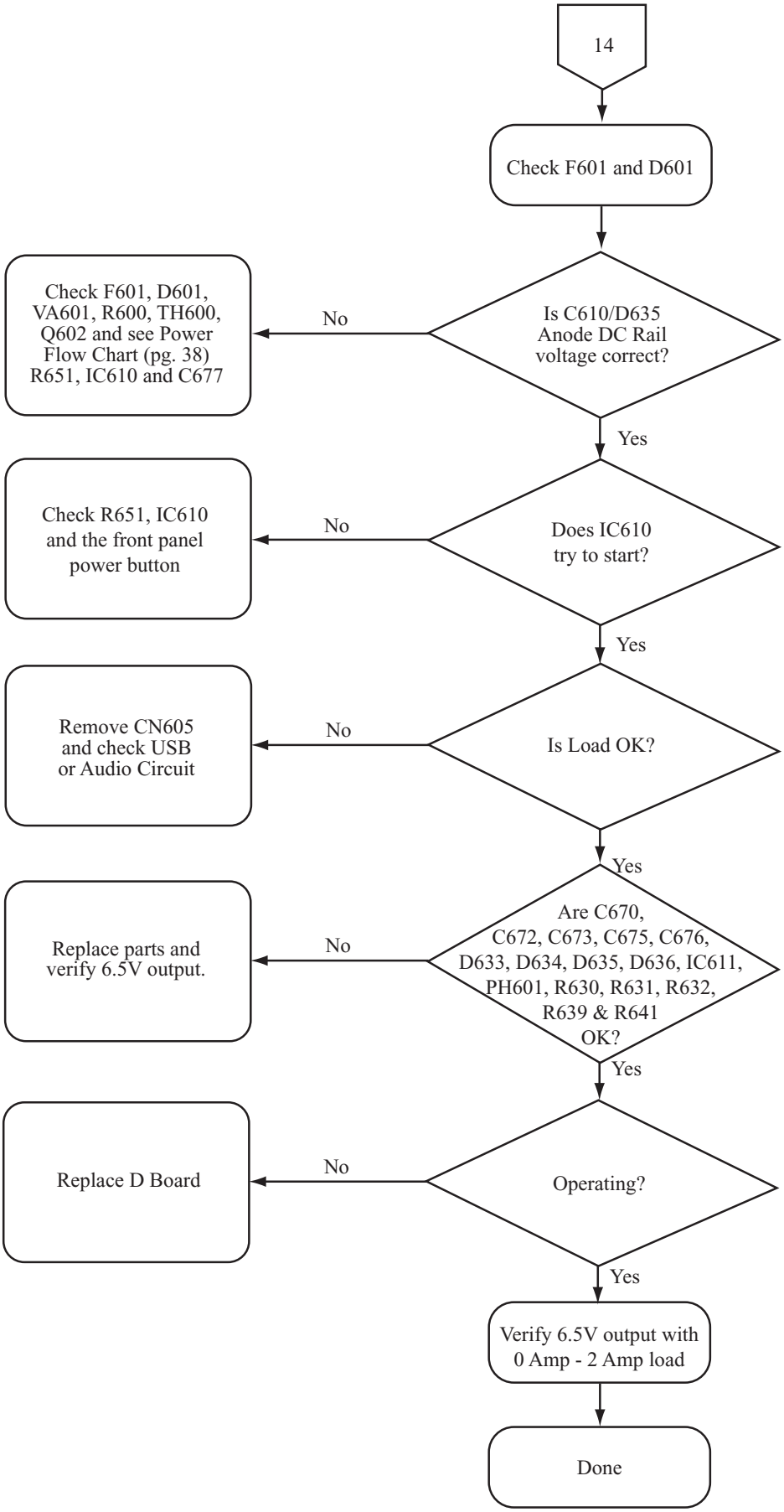
VIDEO


12
Check if I2C bus pins 1 & 2 of IC001 OK?
No
Check connector CN309, IC901 & +5V
Check if CN302 pins 2, 4 & 6 OK?
No
Check signal in
Yes
Check if IC001 pins 20, 24 and 27 OK?
No
Check IC001 and HV
Yes
Check if IC002 pins 1, 3 & 5 OK?
No
Replace parts & verify
Yes
Are cathode DC levels correct?
No
Check IC004 and +B
Yes
Is G2 voltage correct?
No
Check CN301 and FBT
Yes
Change CRT
Done

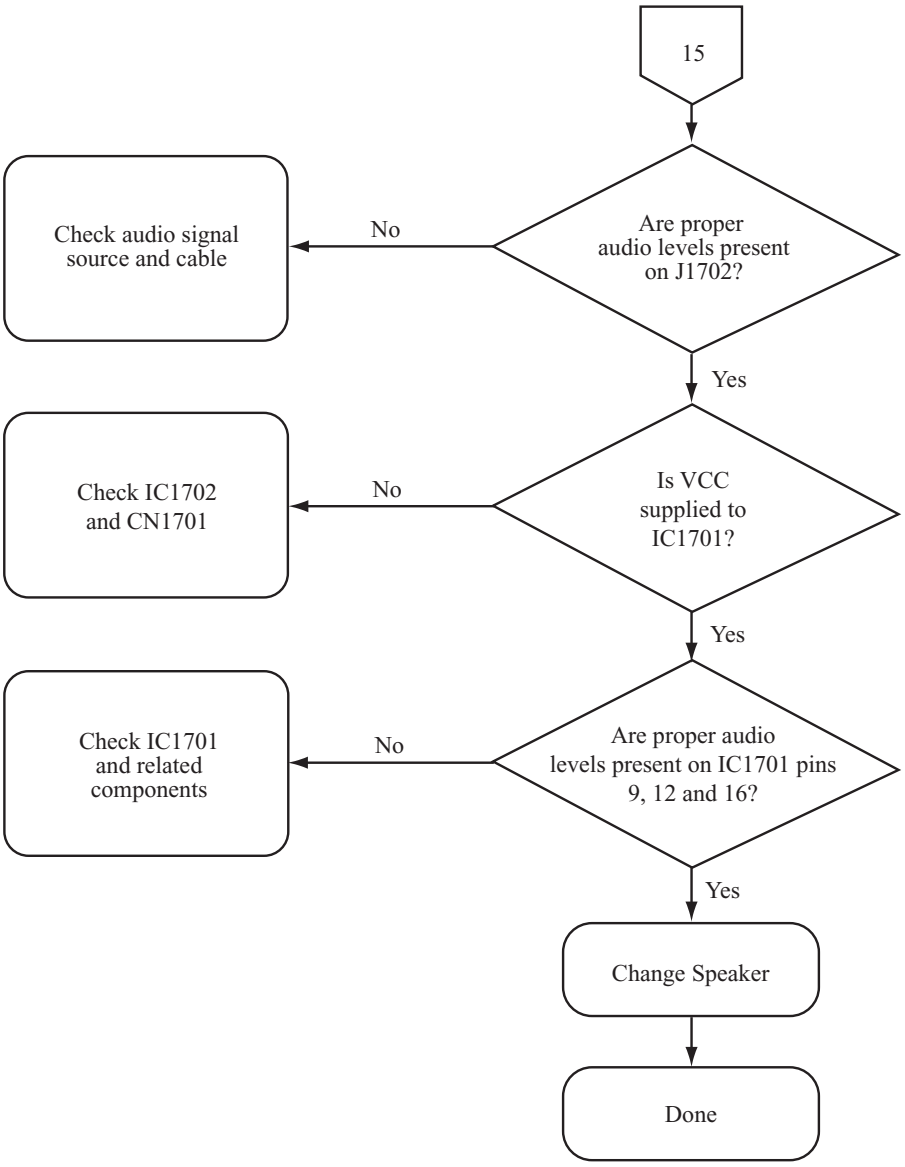
CONVERGENCE


13
Check "CONV_SW" Register is "7"
No
Change "CONV_SW" REGISTER to "7" and adjust monitor
Yes
Check if IC701 outputs pins 8, 9, 6 and 7 are OK?
No
Check IC701, IC605 outputs and +15V power supply
Yes
Check if IC702 outpins 1, 6, and IC703 output pins 2 and 8 are OK?
No
Check IC702 and IC703 +15V & -15V line power supply
Yes
Check CN701 connector if OK?
No
Replace connector and related components
Yes
Replace DY and verify if OK?
Yes
No
Change CRT
Done

USB/AUDIO POWER SUPPLY


14
Check F601 and D601
Is C610/D635 Anode DC Rail voltage correct?
No
Check F601, D601, VA601, R600, TH600, Q602 and see Power Flow Chart (pg. 38) R651, IC610 and C677
Yes
Does IC610 try to start?
No
Check R651, IC610 and the front panel power button
Yes
Is Load OK?
No
Remove CN605 and check USB or Audio Circuit
Yes
Are C670, C672, C673, C675, C676, D633, D634, D635, D636, IC611, PH601, R630, R631, R632, R639 & R641 OK?
No
Replace parts and verify 6.5V output.
Yes
Operating?
No
Replace D Board
Yes
Verify 6.5V output with 0 Amp - 2 Amp load
Done

AUDIO


15
Are proper audio levels present on J1702?
No
Check audio signal source and cable
Yes
Is VCC supplied to IC1701?
No
Check IC1702 and CN1701
Yes
Are proper audio levels present on IC1701 pins 9, 12 and 16?
No
Check IC1701 and related components
Yes
Change Speaker
Done

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